





... like Hannah?

... or forward it is the same.  
... bushels of corn lie unhusked  
... in Franklin county fields.

... headlight for locomotives is  
... on some of the railroads.

... will lecture at the Academy  
... at Haven, on Saturday, the 19th

... that the extremely cold weath-  
... destroyed a large part of the honey

... county man owns an imported  
... which yields 23½ pounds of butter per

... amount of reading matter crowded  
... week on account of legal advertise-

... dy with any refinement will use her  
... 's meerschaum pipe to drive nails in

... miles would last

property of his father's estate  
at the residence of Mr. W. C. William  
Thompson Street, this Borough. The  
will take place on Thursday, February  
1881, at 1 o'clock, p. m. For further  
particulars see large bills.

HANDSOME DRUG STORE.—Dr. G. H.  
of Salladasburg, has one of the hands-  
and most convenient village drug stores  
in this section of the State. It adjoins his  
residence in that place and is admired  
by those who have seen it for its neatness, good  
arrangement, &c. Dr. Cline is not only a  
citizen, but a successful physician, and a  
fixed institution that cannot well be dispensed  
with in that locality. Besides all this he  
is rather a good looking man.

PORTER TOWNSHIP OFFICERS - Justice of

time to  
ALTO  
LAST—  
ma



IRW

1985

*W. B. Riddle*  
*1900*  
*1900*








22501280360



Mrs G. H. Blinn





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*C. H. Cline.*

A

# SYSTEM OF SURGERY;

PATHOLOGICAL, DIAGNOSTIC, THERAPEUTIC,  
AND OPERATIVE.

BY

SAMUEL D. GROSS, M. D.,

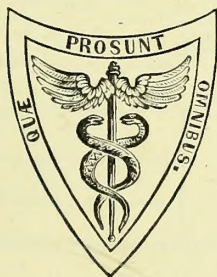
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ILLUSTRATED BY

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VOL. II.



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PART SECOND.

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SPECIAL SURGERY;

OR,

DISEASES AND INJURIES

OF

PARTICULAR ORGANS, TEXTURES, AND REGIONS.



# SYSTEM OF SURGERY.

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## SPECIAL SURGERY; OR, DISEASES AND INJURIES OF PARTICULAR ORGANS, TEXTURES, AND REGIONS.

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### CHAPTER I.

#### DISEASES AND INJURIES OF THE BONES AND THEIR APPENDAGES.

THE bones, being organized upon the same principles as the soft structures, are liable to similar diseases, both of a benign and a malignant nature. The presence of earthy matter, however, to which the bones are indebted for their solidity and strength, so as to render them fit organs for locomotion, exerts, as is well known, a modifying influence, not only upon the frequency of their diseases, but also upon their progress, the character of their products, and the mode of their termination. This influence is particularly noticeable, on the one hand, in the difficulty with which inflamed osseous tissue suppurates, and, on the other, in the facility with which it becomes softened and deprived of its vitality, even, apparently, under very slight action. Inflamed soft texture generally suppurates with remarkable readiness, and often becomes the seat of large abscesses; in pure osteitis, on the contrary, pus is rarely seen in any form, much less in that of abscesses, such an occurrence being usually impossible, first, on account, it may be supposed, of the peculiar habits of the secernent vessels, and, secondly, because of the absence of free cellular substance, which, in the soft tissues, always serves as a bed for the reception and accommodation of the purulent fluid. Bones inflame with difficulty, but when the morbid process is once fairly lighted up, it is sure to produce serious structural disorder, often followed by the worst consequences, as softening, protracted ulceration, hypertrophy, fragility, and even necrosis, or the death of the affected parts. In tertiary syphilis, gout, rheumatism, and scurvy, the bones frequently suffer immensely, receiving and harboring disease with great facility. They are a common seat of various kinds of tumors, especially the benign, some of which, as the exostoses, are identically similar to their own structure, while others are essentially different in most particulars. The heterologous formations have all been observed in the skeleton, but their great rarity has been a sub-

ject of remark by every systematic writer. The most common of these formations is the tubercular, which plays so important a part in caries of the carpal and tarsal bones, in Pott's disease of the spine, and in strumous affections of the larger joints of the extremities.

#### SECT. I.—PERIOSTITIS.

The occurrence of periostitis is by no means infrequent, its causes being those of osteitis, with which, especially in its acute form, it is usually associated. Among the most common of these causes are various kinds of external injury, such as fractures and dislocations, blows, contusions, gunshot wounds, and the application of escharotic substances; and the effects of gout, rheumatism, and syphilis, operating upon a disordered and broken-down state of the system. There is one form of whitlow which consists essentially of periostitis, attacking usually one of the fingers, and liable, if neglected, or improperly treated, to terminate in extensive suppuration and necrosis of the distal phalanx. Inflammation of the periosteum, of a very severe and destructive nature, is occasionally produced by deep-seated abscesses, extending to, and irritating that membrane, as happens, for example, sometimes in phlegmonous erysipelas, where the matter burrows extensively among the surrounding tissues. Two forms of the disease are met with, the acute and chronic, the latter being the more common.

#### ACUTE PERIOSTITIS.

In the acute form of inflammation, the fibrous membrane is somewhat discolored, being commonly of a reddish, pink, or lilac hue; its vessels are loaded with blood, and its substance is sensibly softened, as well as slightly thickened from interstitial deposits. Its attachment to the bones is also considerably diminished, so that it may be pretty readily peeled off, and the cellular substance immediately over its outer surface is generally infiltrated with sero-albuminous matter. These changes, which are present, in greater or less degree, in all cases of periostitis, are often very conspicuous upon the fragments of a broken bone, and in incised wounds of the muscles, involving the membrane in question.

The disease not unfrequently passes into suppuration, the occurrence being particularly liable to happen in the periosteum of the bones of the inferior extremity, as the femur and tibia, and in the phalanges of the thumb and fingers; in the former as a consequence of cold acting upon a strumous constitution, or of the effects of mercury, or of mercury and syphilis, and in the latter as a result of whitlow. Much diversity exists in regard to the progress of the suppurative action; most generally it is rather tardy, but there are cases in which it proceeds with extraordinary rapidity, committing excessive ravages in a few days. However this may be, the pus is rarely of a healthy, laudable nature, but almost always very thin, bloody, and offensive, with flakes of curdy matter and the débris of broken-down soft tissue.



Mortification is another termination of this disease, the occurrence being characterized by the dirty, ash-colored appearance of the affected membrane, which is, moreover, very much softened in its texture, and saturated with a foul offensive fluid, emitting an unmistakably gangrenous odor. Such an event is necessarily associated with necrosis of the corresponding bone, and frequently, also, with mortification of the endosteum, all perishing together in consequence of the destruction of their vascular connections. The best examples of this mode of termination occur in the periosteum of the alveolar processes of the jaws, from the abuse of mercury, and in that of the tibia from the effects of syphilis. The sloughs, which are always tough and shreddy, are usually thrown off with considerable difficulty, owing to the tardy and imperfect action of the circumjacent structures.

*Symptoms.*—The symptoms of periostitis are such, usually, as attend inflammation of the deep-seated structures generally, the pain being of a violent and pulsatile character, and the swelling of the soft parts diffuse and cedematous, with excessive heat of surface, and more or less constitutional disturbance. The occurrence of suppuration is announced by a marked increase of suffering; and as the pus accumulates the superincumbent integuments assume a shining, glossy, erysipelatous aspect, pitting under pressure, and imparting a distinct sense of fluctuation. Both in suppuration and mortification the pain is exquisite, and the patient generally labors under high fever and often also under delirium.

In periostitis consequent upon a syphilitic taint of the system, the suffering is always worst at night, the pain being of a severe, aching, or gnawing character, and invariably aggravated when the patient becomes warm in bed. Small, circumscribed swellings, or nodes, frequently exist, and are exquisitely tender on pressure and motion, the skin over them being red, inflamed, and cedematous. The contents of these swellings are generally of a thick gummy character, possessing none of the properties of genuine pus.

In gouty and rheumatic periostitis the pain is deep-seated, wandering, or migratory, and generally very severe; the soft parts over the seat of the disease are discolored, glossy, and puffy; slight effusions of sero-plastic matter often exist beneath the affected membrane, forming small, rough, and irregular swellings, which are easily detected by the finger; the system is disordered by fever; the perspiration is acid and copious; and the urine is scanty and high-colored, depositing a large quantity of lateritious substance upon the bottom of the receiver. The most reliable symptoms, in a diagnostic point of view, are, the shifting character of the disease, the involvement of the joints, and the history of the case.

*Treatment.*—In the treatment of periostitis, a primary object is to seek for the cause of the disease, and, if possible, to remove it. The traumatic form is to be managed upon ordinary antiphlogistic principles, and need not, therefore, detain us here. Idiopathic periostitis is often a self-limited affection, tending to terminate in suppuration, despite the best directed efforts of the surgeon. Examples of this constantly occur in whitlow and in some varieties of necrosis, in which

periostitis commonly plays an important part, the morbid action being apparently dependent rather upon some inscrutable constitutional trouble than any special local cause. General treatment can seldom be altogether dispensed with in any case, while in many it constitutes our most valuable resource, no progress of a favorable character being made without it. In the more severe forms, bloodletting, active purgatives, and the saline and antimonial mixture, will probably be required, along with anodynes, to allay the excessive pain which is so often present. The most important topical remedies are leeches, iodine, blisters, and saturnine lotions with laudanum. If great tension exist with a tendency to suppuration, deep-seated incisions are made, without waiting for fluctuation, which is often extremely difficult of detection, unless the affected structure happens to be very superficial, as in periostitis of the tibia. The necessity of this operation cannot be too strenuously insisted upon, as it is the only way in which we can afford prompt relief to the suffering, and obviate extensive and irremediable mischief, as must inevitably be the case when the matter is permitted to burrow. When mortification takes place, the same treatment must be adopted as under ordinary circumstances.

In syphilitic periostitis the best remedy is iodide of potassium, in doses of from five to ten grains three times a day, either alone or in union with bichloride of mercury. If nodes form, they will generally disappear under the influence of the application of iodine, blisters, or mercurial inunctions, and will seldom demand interference with the knife.

Rheumatic and gouty periostitis will require the use of colchicum, with systematic purgation, and occasionally, perhaps, slight ptyalism, with leeches, fomentations, and alkaline and anodyne liniments.

#### CHRONIC PERIOSTITIS.

The periosteum is often the seat of chronic inflammation, its substance becoming thickened and indurated from the effusion of plastic matter. The hypertrophy—for so it may be termed—often involves a considerable extent of surface, forming a diffuse, incompressible swelling, fibrous, cartilaginous, or even osseous in its character. Sometimes, on the other hand, the enlargement is very small and circumscribed, not exceeding, perhaps, the end of the little finger or half a dime. It may be caused by some specific constitutional poison, especially the syphilitic, or by external violence, as a blow, fall, or kick, as is often the case when it exists on the skull. However induced, its development is attended with a constant, deep-seated, gnawing pain, which is usually most severe at night when the body becomes warm in bed, and which occasionally assumes a true neuralgic character. After continuing for an indefinite period, it often remains stationary, or it gradually disappears by absorption, or it excites suppuration in the superimposed tissues.

These chronic affections of the periosteum are generally peculiarly obstinate and intractable, requiring specific remedies, frequently varied and long-continued, for their cure. Iodide of potassium and mercury,

Donovan's solution, and the different preparations of arsenic, with blisters, iodine, leeches, the vapor bath, and mercurial fumigations, are the means most likely to prove beneficial. In obstinate cases, resisting the ordinary remedies, free incisions, extending through the substance of the thickened and indurated membrane down to the very bone, will afford more relief than anything else, especially if the wound be made to suppurate abundantly.

Bony tumors, growths or deposits of this membrane are to be treated upon the same principles as exostoses, properly so termed. When small, not painful, or not inconveniently situated, they will probably require no attention. Occasionally they disappear spontaneously, or under the influence of very simple remedies. Such formations are nearly always caused by the effects of the gouty, rheumatic, or syphilitic poison, and are, therefore, generally greatly benefited by iodide of potassium and a mild course of mercury.

Finally, the periosteum is sometimes the seat of the heterologous formations, as the melanotic and tubercular. In carcinoma of the bones, the membrane is now and then implicated secondarily, but is rarely, if ever, the primary seat of this malady. In a number of dissections which I have made of encephaloid disease of the bones and soft parts, I have found it entirely intact, not even thickened or indurated.

#### SECT. II.—ENDOSTEITIS, OR OSTEOMYELITIS.

Under this name, one of recent introduction into surgical nomenclature, may be described a disease of the medullary membrane, now known as the endosteum, possessing all the characters of true inflammation. Faint traces of such an occurrence are to be found in several authors of the last century, but it is only within the last few years that special attention has been called to it, or that the subject has been studied in a scientific manner.

The *causes* of this affection are generally of a traumatic nature, consisting of fractures, gunshot wounds, the lodgment of foreign bodies in the substance of the bones, violent blows, contusions, concussion of the spongy tissue, and laceration of the endosteum by the saw in amputation of the limbs, of which the lesion is by no means an uncommon consequence, as is shown by the suppuration and necrosis which so often follow this operation. There can be little doubt that the inflammation is frequently produced by the mere concussion of the limbs, transmitting its injurious effects along the canals of the long bones, thereby, perhaps, partially detaching portions of the lining membrane, and so inducing serious disruption of the circulation. Cold is another cause of endosteitis, and there is reason to believe that many of the cases of necrosis of the shaft of the femur, tibia, and other long pieces of the skeleton originate in this manner. Occasionally the malady depends upon some constitutional taint, as the syphilitic, strumous, or scorbutic, awaking inflammation consentaneously in the endosteum, osseous tissue, and periosteum.

The morbid *anatomy* of the disease is best studied in one of the long



bones, as the femur or tibia, after amputation. If several days have elapsed since the operation, the membrane will be found to be of a pale pink hue, more or less injected, and apparently a little thickened, the marrow is abnormally soft, and the cells of the spongy structure of the canal are pervaded by a sero-sanguineous fluid. At a later period, when the inflammation is more fully established, the discoloration of the endosteum is of a more decided character, being of a deeper red with a shade of brown or purple, the fatty matter is broken up into a semi-liquid substance, and, in addition to the bloody sanies just alluded to, evident traces of pus are seen, forming numerous little points, of a yellowish aspect, which, gradually coalescing, at length assume the character of small abscesses. When the disease is uncommonly violent or protracted, portions of the endosteum are found to be converted into real eschars, of a brownish color, and of a characteristically fetid smell; the periosteum opposite the seat of the morbid action becomes detached, and the intervening portion of the bone, thus deprived of its vessels, speedily perishes.

The *symptoms* of endosteitis are vague and unreliable, it being difficult, if not impossible, to distinguish them from those which attend inflammation of the bones and their fibrous envelop. Indeed, it is only when the disease occurs as the result of injury, as after amputation, that anything even like a plausible conjecture can be formed as to its real nature. Under such circumstances, upon taking off the first dressings, the wound opposite the end of the bone will probably be found to be gaping and filled with pus, the bone itself being either entirely denuded, or only slightly covered with lymph below, while the medullary membrane is of a reddish or brownish color, and more or less vascular. If six or eight days have elapsed since the operation, the exposed medullary surface will be likely to be studded with pale, flabby, unhealthy granulation, somewhat sensitive to the touch, or perhaps even quite painful, and discharging an abundance of thin, sero-sanguinolent fluid. Around this red and inflamed circle, the compact layer exhibits an unusually white, glistening appearance, without any trace of reparative action; in fact, the bone seems to be more dead than alive, or, if not actually dead, it will soon be. Superadded to these phenomena, there is occasionally a discharge of marrow, with or without fragments of the medullary membrane; a sure sign of the inflamed and disorganized state of the parts.

Endosteitis is always attended with considerable swelling and puffiness of the soft structures immediately over the affected parts, but there is not necessarily any discoloration of the surface, or any unusual pain. Considerable irritative fever is commonly present; the skin has a peculiar sallow hue; and there are apt to be rigors, alternating with flushes of heat, and followed by copious sweats, generally of a disagreeable acid nature. When the disease is idiopathic, there may be tumefaction and pain, deep seated and throbbing, at the site of inflammation, but neither of them of so distinctive a character as to be of any service in a diagnostic point of view.

Endosteitis cannot be considered otherwise than as a dangerous malady; for, when severe or extensive, it is not only apt to cause ex-



tensive necrosis, but may destroy the patient by the induction of phlebitis in the principal veins of the corresponding limb, and abscesses in the different viscera, especially the lungs and liver. Occasionally, it would seem to be capable of assuming a sort of endemic tendency. Thus, in 1814, nearly all the patients at the Hôtel Dieu, in Paris, who died after amputation, and the number was quite considerable, were observed to have suppuration in the medullary membrane of the long bones.

The *treatment* of endosteitis must be conducted upon general anti-phlogistic principles, local and constitutional, in the hope of limiting morbid action and preventing the occurrence of suppuration and gangrene. If the medullary canal be exposed, some mildly stimulating injection, such as a very weak solution of nitrate of silver, tannin, or acetate of zinc, may be useful, the part being protected from the atmosphere by lint wet with a similar fluid, or an emollient cataplasm. If the membrane be affected in its continuity, and there is much swelling of the soft structures, free incisions may be necessary in order to relieve tension and promote the escape of effused fluids; and if there be reason to apprehend the existence of medullary abscess, as there will be if there be deep-seated, aching, gnawing, or boring pain, with œdema of the subcutaneous cellular tissue, the surgeon must not hesitate to cut down upon the matter with the crown of a small trephine as the only chance of averting still more serious consequences.

#### SECT. III.—OSTEITIS.

Osteitis, or inflammation of bone, at one time regarded as uncommon, is, on the contrary, of frequent occurrence, especially in early life, owing, doubtless, to the great vascularity of the osseous tissue at that period rendering it more susceptible of disease than in old age, when many of the vessels shrink and disappear. The lesion may be primitive or consecutive, acute or chronic; and in either case it may be limited to a particular portion of a bone, or pervade its entire length and breadth, although this is unusual. The spongy tissue suffers more frequently than the compact, a circumstance which is apparently due to the greater vascularity of the former than of the latter; and what is particularly remarkable is that in the first the disease often passes into ulceration, while in the latter it more frequently causes necrosis, or mortification, the two structures being evidently endowed with different powers of resisting the effects of inflammation. The pieces most liable to be affected are those which are naturally the least covered by soft substance, as the tibia, fibula, ulna, clavicle, and frontal bone. The disease is generally slow in its progress, and hence a considerable period may elapse before there is any very appreciable alteration of tissue. Cases, however, occur, where it proceeds with immense and overwhelming rapidity, suppuration, ulceration, and even mortification appearing in less than forty-eight hours from the commencement of the attack.

If a bone laboring under inflammation be carefully examined, it will be found to exhibit several important structural changes of great

interest. At first it is simply enlarged, although less so than is usually imagined, because much of what appears to be enlargement is due rather to swelling of the periosteum, which is nearly always present under such circumstances, than to any actual expansion of the osseous tissue itself. Gradually the affected bone loses its density, becoming softened, and infiltrated with a sanguinolent fluid, of a sero-plastic nature, and assuming a bright reddish hue, the capillaries being very numerous, turgid, and distinct. As the disease advances, the osseous fibres separate from each other, and the widened intervals are immediately filled with inflammatory deposits, often intermingled with little clots of pure blood. These alterations are always attended by an absorption of earthy matter, which has the effect of rendering the bone both soft and spongy, at the same time that it causes an actual diminution of its weight. The lamellæ of the compact substance are resolved, as it were, into their primitive distinctness, the Haversian canals are greatly enlarged, and the cells of the areolar texture are remarkably rarefied. When the disease has reached its maximum, the bony tissue is frequently so soft as to admit of being bent and cut with considerable facility. When the inflammation is superficial, affecting the outer layers of a bone, it always promptly extends to the periosteum, which, in consequence, becomes hot, red, and swollen, its substance being infiltrated with serous and plastic effusion. If, on the other hand, the inner structure is involved, the endosteum is sure to suffer, assuming a discolored, bloodshot appearance, while the adipose matter is either rapidly absorbed, or converted into a soft diffuent mass, of a light reddish hue, and of a peculiarly fetid character. When the inflammation of the bone is at all extensive, both periosteum and endosteum participate in the morbid action, and it is in these cases, more especially, that, the circulation being cut off by fibrinous exudations, necrosis is so liable to arise.

Osteitis may terminate in resolution, the morbid phenomena gradually disappearing, and the affected structures regaining their primitive texture; or the disease may cease, and the bone become indurated and enlarged in consequence of interstitial osseous deposits; or, lastly, the inflammation may pass into suppuration, ulceration, softening, or mortification, the results resembling those of inflammation of the soft parts. It is seldom that a bone, after having been inflamed for any length of time, will not, upon recovery, remain somewhat hypertrophied, or larger and harder than it was before the attack (fig. 1).

Fig. 1.



Hypertrophy of the tibia from inflammation.

It is, in fact, nature's mode of cure, the process which she employs for repairing the mischief committed by the disease.

*Causes.*—The causes of osteitis are either traumatic or constitutional, the former consisting of injuries inflicted in surgical operations, fractures, contusions, and wounds, especially gunshot and punctured, and the latter of a syphilitic, strumous, scorbutic, rheumatic, or gouty taint of the system, together with the operation of cold. The disease may begin directly in the osseous tissue, or this may be involved secondarily, in consequence of the extension of the disease from the surrounding parts. Thus, in dislocations, particularly compound, and also in simple dislocations of the larger hinge joints, as the elbow and knee, the inflammation consequent upon the accident is nearly always communicated to the contiguous extremities of the bones, rendering them soft and brittle, and liable to give way under slight influences. In like manner the periosteum often becomes the propagator of the morbid action; for, although, in general, this membrane serves to ward off disease, forming a kind of wall between the soft structures and the bones, yet this barrier is not unfrequently overleaped, and inflammation kindled up in the very centre of these pieces. A great similarity is thus found to exist between the bones, periosteum, and endosteum, on the one hand, and the lungs, pleura, and bronchial mucous membrane on the other, experience having proved that disease cannot be present in any considerable degree, or for any length of time, in any one of these component elements without being propagated to the rest, which subsequently have often to bear the chief brunt of the incited action.

*Symptoms.*—The symptoms of osteitis bear a great resemblance to those of periostitis and endosteitis, and hence the most adroit diagnostician often finds it difficult to discriminate correctly between them. Practically, an error of this kind is of no special moment, as the treatment is essentially similar in the three affections, but as a matter of science it would certainly be desirable in every instance to ascertain, if possible, in what structure the disease is located, or if all are implicated, in what degree. There is really, however, no one symptom, or group of phenomena, upon which the least reliance can be placed as a means of discrimination. It may be said that the pain in osteitis is more intense, agonizing, and deep-seated, than in inflammation of the periosteum and endosteum, and yet this is true only as a general rule; in the great majority of cases the difference is too slight to be appreciable. The same is true in regard to the swelling of the soft parts, and the constitutional disorder, which are often considerable in all these affections, but as they do not possess any distinctive features, are of no value in a diagnostic point of view.

Acute inflammation of bone is generally attended by the same symptoms as acute inflammation of the soft structures. The pain is excruciating, the part feeling as if it were torn, or bored, or as if insects were feeding upon it; it is deep-seated, more or less circumscribed, and increased by motion, pressure, and damp states of the atmosphere: it is also usually more violent at night when the patient becomes warm in bed, especially when it recognizes a constitutional origin. The swelling is extensive, firm, and almost inelastic, pitting, perhaps, after a time, under the application of the finger; the skin



has a glossy, shining appearance; and there is intense heat of the surface, conjoined, in most cases, with an erysipelatous blush. The constitution sympathizing powerfully with the local disorder, there is high fever, with excessive thirst, a full, bounding pulse, and great dryness of skin, with all the minor phenomena of general incited action. If the disease be not promptly restrained by appropriate antiphlogistic measures, the soft parts suppurate, the event being announced by rigors and delirium, followed by copious sweats.

Osteitis is seldom dangerous to life, but may prove fatal if it be extensive, or complicated with other maladies. It often terminates in serious and irremediable structural disease of the affected part, as softening, caries, and necrosis, requiring important operations, which are themselves frequently a source of much risk. Recovery, in any event, is generally extremely tedious.

*Treatment.*—The treatment of osteitis must be conducted upon general antiphlogistic principles, of which bleeding, if the patient be at all robust, tartar-emetic, purgatives, calomel, and opium, with perfect rest both of the part and body, constitute most essential elements. The prompt abstraction of blood by the lancet, or by leeches from the affected structures, will generally prove of marked benefit in cutting short the disease, or, rather, in limiting the sphere of its action. Calomel should be given as soon as the patient has been well bled and purged, and should be steadily continued until gentle ptyalism has been provoked. There is no remedy which, after proper depletion has been premised, exerts so powerful and controlling an influence over inflammation of bone as this; and, although it should not be used sakelessly, or without due precaution, there are few cases to which it is not applicable. To prevent it from running off by the bowels, and, at the same time, to mitigate the excessive general and local distress, it should be administered in combination with large doses of opium, repeated as frequently as the exigencies of the case may seem to require.

The best local remedies, besides leeches, are hot anodyne fomentations, light medicated cataplasms, dilute tincture of iodine, and blisters, the latter being applied in such a manner as to cover in the whole of the affected surface, and allowed to remain on until thorough vesication has been produced. If matter form, or even if there be merely great tension, the knife must be used, the incisions being made long, and extended down to the very substance of the bone. Without such an expedient relief is impossible. If the pus be allowed to accumulate, it will be sure to burrow, insinuating itself freely among the muscles, and perhaps even between the periosteum and bone, thereby detaching these parts from each other, and thus inducing extensive necrosis. What is done for the soft tissues, under such circumstances, should be done also for the affected bone, although practitioners are generally agreed to let it take care of itself. Is this good practice? The surgeon makes it a rule in inflammation of the soft structures to relieve pain and swelling by early and free incisions, and he finds that the procedure is usually followed by the most happy results, texture being saved and much suffering avoided. Why should he not adopt a similar treatment in osteitis attended with swelling and excruciating torture in consequence



of effused fluids? Several openings might be very easily made into the affected bone with the crown of a very small trephine, the soft tissues being carefully divided as a preliminary measure. The operation never fails to be beneficial, and there is reason to believe, from what I have seen of it in my own practice, that if it were more frequently resorted to than it is there would be much fewer cases of necrosis and caries than are now seen to follow this disease.

In chronic osteitis our chief reliance is upon alterants, purgatives, and counter-irritation, of which the best form is an issue made with the hot iron as near as possible to the seat of the disease. A free discharge should be established and steadily maintained until the morbid action is effectually broken up. The most reliable alterant is iodide of potassium in union with bichloride of mercury, carried, in obstinate cases, to gentle and somewhat persistent pyalism. Such a course is particularly indicated in syphilitic osteitis, but is hardly less beneficial in the rheumatic, gouty, and strumous forms of the malady.

#### SECT. IV.—SUPPURATION AND ABSCESS.

Suppuration of the external surface of bone is a very common occurrence, and may arise from various causes, as fracture and other external injury, or a syphilitic taint of the system. As the morbid action, however, which precedes and accompanies the suppuration, is usually associated with inflammation of the periosteum, it is difficult, in most cases, to determine which structure is really the source of the purulent matter. When the osteitis is of long standing, or characterized by inordinate severity, the pus is occasionally diffused through the proper substance of the bone, but such an occurrence can only happen in the event of the osseous tissue having undergone previous softening, the removal of the earthy matter being followed by the formation of cells or cavities for the lodgment of the fluid. If a vertical section be made of a long bone, as the tibia, in an advanced state of inflammation, it will be found that the pus, presenting itself in small globules, will be scattered both through the Haversian canals and the cells of the areolar substance, no disposition being manifested in the little dépôts to arrange themselves into abscesses. The intermediate structure is of a reddish color, filled with fibrinous exudation, and so soft as to be easily divided with the knife. This punctiform variety of suppuration is seldom so conspicuous as in inflammation of bone complicated with endosteitis.

*Abscess* of bone (fig. 2), distinct, circumscribed and well-defined, such as we see in phlegmonous suppuration of the soft parts, is an occurrence of extreme rarity. Many writers, indeed, have denied its existence altogether, but this is certainly carrying conjecture too far, since the establishment of such an abscess has been more than once attested by dissection. The formation takes place slowly, an unusual degree of chronicity being one of the natural concomitants of the disease. The most common seat of abscess is the head of the tibia, or

Fig. 2.



Abscess in bone.

3). Finally, in a third class of cases, the matter continues to accumulate, apparently for a long time, and pressing upon the osseous tissue in every direction, gradually expands the bone into a large shell, capable of holding several ounces, and so thin and soft as to be bent and cut like cartilage.

Fig. 3.



Large chronic abscess of the tibia, the bone being much thickened as well as expanded round the cavity.

the head and lower extremity of that bone, the expanded and rarefied tissue of which is peculiarly well adapted to such an occurrence. The abscess ranges in size from that of a pea to that of a pigeon's egg; is generally solitary; is lined by a thin though distinct membrane; and is occupied by a dark-colored, ill-elaborated pus, more or less fetid, and intermingled with aplastic matter or curdy flakes similar to those observed in strumous pus. The surrounding tissues are softened, congested, and infiltrated with sero-sanguinolent fluid. The manner in which the abscess terminates is variable; when seated near the extremity of a bone, it sometimes manifests a disposition to discharge its contents into the contiguous joint; at other times, and more generally, it maintains its position, becoming as it were encysted by the deposition of new bone around it, as delineated in the following sketch (fig.

The *symptoms* denotive of the formation of pus are usually such as characterize this event in the other tissues, only that the local suffering is generally more intense, especially if the matter has no free vent. The existence of abscess in the interior of a bone is indicated by a dull, gnawing, heavy pain, circumscribed, deep-seated, remittent, and more like a violent toothache than anything else to which it can be compared. In many cases it is of a throbbing, boring, tearing, or lancinating nature. It is always worse at night than in the day, and is usually so intense and exhausting as to make serious inroads upon the general health, the patient soon becoming wan and sallow, and affected with hectic irritation. Occasionally the pain completely intermits, the parts being wholly free from suffering for many hours, and even days together; more generally, however, it is continued with partial remissions. The soft structures, at the seat of the abscess, are always exquisitely tender, especially at one particular spot directly over the

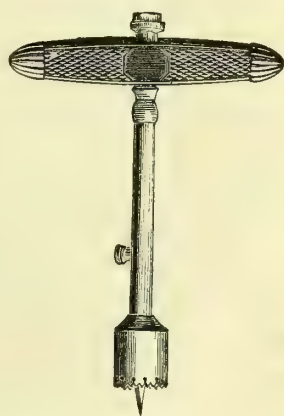
matter, more or less tumefied, glazed, and cedematous, often pitting on pressure. The formation of matter is generally announced by rigors, alternating with flushes of heat, and similar attacks are very common

during the progress of the disease, particularly in the early part of the night, the body being usually drenched under such circumstances, towards morning, with acid, offensive perspiration.

Although the symptoms of abscess are in general well marked, yet, as they are liable to be simulated by other affections, they cannot be said, in the true sense of the term, to be characteristic. The principal affections with which they are liable to be confounded are necrosis and deposits of new bony matter, compressing and irritating the parts so as to keep up intense pain and tenderness, similar to those produced by collections of pus in the soft structures. Fortunately, accuracy of diagnosis is of little consequence in these cases, as the treatment is essentially the same, whether the symptoms arise from abscess, the lodgment of dead bone, or interstitial osseous deposits. The discrimination between abscess and neuralgia, which often closely imitate each other, is of more importance, on account of the difference of treatment, but so far as I know there are no diagnostic signs by which the distinction can be effected.

Abscess of the osseous tissue admits of relief only in one way, and that is by efficient evacuation with the trephine, for in no other manner can the pent-up fluid be reached. The operation is not always as easy as might at first be imagined, owing to the excessive firmness of the affected bone, in consequence of interstitial deposits, which often give it the closeness and density of ivory. The best instrument is a common cranium-trephine, with a caliber from three to four lines in diameter, with sharp, well set teeth, and fluted at the surface, so as to make a wide track. If any difficulty is apprehended on account of the extraordinary hardness of the bone, it will be proper to have two saws, of precisely the same size, in order that there may be no delay in the operation in the event of an accident. The surgeon, taking the site of pain and swelling, or the "tender spot," as his guide to the seat of the abscess, exposes the bone by a free incision, either single, T like, or crucial, as may be deemed necessary, and then turning aside a small portion of periosteum, applies the trephine (fig. 4), the centre-pin being protruded until the instrument has made for itself an adequate groove. The arrival of the saw in the abscess is generally denoted by a sudden cessation of resistance, and by the escape perhaps of a few drops of pus mingled with blood. If no matter be found after sinking the instrument to a considerable depth, it is applied at some other point, in the vicinity of the former, in the hope of a more successful result, for it is often quite impossible, in these cases, to hit the precise spot where the matter is located in a first or even a second attempt: on the other hand, however, care must be taken not to make too many perforations, lest the bone be thereby unduly weakened or suffer other injury. Moreover, it is not to be inferred by any means, that, although no pus

Fig. 4.





has been detected, the operation will, therefore, be a failure; perhaps the instrument may have come in contact with a small sequester, lying loose in the cellular tissue of the articular extremity of the bone, and by removing this, rapid recovery may take place; or, instead of this, the pain and other symptoms may have been occasioned by the pressure of interstitial deposits, and the excision of a disk of bone may afford relief on the principle of taking off tension, as a free incision does in deep-seated purulent collections in the soft structures.

The abscess having been opened, its cavity is washed out with the syringe, as much to get rid of the sawdust as to clear away pus and stimulate the pyogenic sac; a narrow tent is then inserted into the bottom of the opening, and the wound gently supported with adhesive strips, the after-treatment being conducted upon strictly antiphlogistic principles. The relief from the operation is often immediate, and there is no class of cases in which the efforts of the surgeon are generally rewarded with more unalloyed satisfaction. The patient, tortured for months with pain and sleepless nights, is suddenly translated from torment into Elysium.

#### SECT. V.—CARIES, OR ULCERATION.

Caries is a disease of the osseous tissue, strictly analogous to ulceration of the soft parts. It is essentially of an inflammatory type, and is characterized by an increase of vascularity, softening, and disintegration, the earthy matter being separated from the animal, and eliminated along with the discharges, which are often quite profuse, especially when the malady has made considerable progress. Caries differs from ordinary osteitis chiefly in this, that it is attended with actual loss of substance, the affected tissue being gradually broken down, excavated, or destroyed, whereas, in the latter, it retains its different elements, although in an altered condition, the principal changes consisting in congestion, softening, and sero-plastic infiltration. There are other points of difference, as the seat of the two diseases, the age at which they respectively occur, and the nature of the concomitant secretions, which will be rendered evident by a careful study of the subject.

Caries is most liable to occur in those pieces of the skeleton which are distinguished by the abundance of their areolar tissue. Hence it is most common in the vertebræ, the sternum, the innominate bones, the bones of the carpus and tarsus, and the articular ends of the long bones, especially of the femur, tibia, and humerus. The compact tissue is more frequently the seat of necrosis than of caries; indeed, the affection cannot occur here unless this tissue has previously undergone a certain degree of softening, so as to prepare it, as it were, for the disintegrating process which characterizes it.

Young persons are most subject to caries, particularly children under ten years of age; it is seldom that it is met with even so late as middle life, and then chiefly as a result of some specific taint of the system, more especially the syphilitic. I am not aware that sex



exerts any material influence upon its production, for I think it has occurred in my own practice with nearly equal frequency in males and females. Temperament and occupation may predispose to it, but if this be so we have no positive proof of the fact. Strumous children are particularly obnoxious to caries, and this circumstance, of which daily observation furnishes abundant evidence, long since created a doubt in my mind whether the disease is not really, in a great majority of cases, of a tubercular nature. The further I examine the subject, the more I am satisfied of the truth of this opinion. Most of the children that are brought to me with this disease, as it occurs in the spine, the hand, foot, and ends of the long bones, present all the characteristic features of the scrofulous diathesis; and I am quite sure that this experience, instead of being peculiar to myself, must be common to all practitioners. I do not, therefore, throw out this view as a mere conjecture, but as a conviction, and shall speak of it hereafter as the basis of important therapeutic indications.

*Causes.*—The causes of caries are of two kinds, local and constitutional, of which the latter are by far the more common and influential. As appertaining to the first, are various injuries, as blows, kicks, falls, fractures, contusions, and concussions, disturbing the circulation and innervation of the osseous tissue, or depriving it of its fibrous covering, and thus modifying its nutritive action. In the bones of the foot, especially those of the tarsus, the disease is sometimes induced by the penetration of a foreign body, as a nail, or splinter of wood. The sawing of the bones in amputation and resection, and their accidental division by sharp instruments, is occasionally followed by caries, both extensive and protracted. Cases occur where the disease is produced by the pressure of an aneurismal tumor, and by the application of escharotic substances.

Among the internal causes of caries may be cited whatever has a tendency to induce general debility, or to impoverish the fluids and solids, and, consequently, to exhaust the innervation. Hence we may place at the head of the list severe and protracted courses of mercury, the operation of the syphilitic poison, a gouty or rheumatic state of the system, scurvy, scrofula, profuse loss of blood, and severe attacks of dysentery, diarrhœa, typhoid fever, and eruptive diseases, as scarlatina, measles, and smallpox. All these circumstances are, as is well known, capable of producing ulceration both in the skeleton and the soft parts, as is proved by the numerous sores which so often arise in different regions of the body, as the sequelæ of these affections, and which we usually find so difficult of cure.

Of all the internal causes, however, of caries, there is none which, in my opinion, exercises so powerful an influence in the production of this disease as scrofula. In making this remark, I do not mean to say that there is always, under such circumstances, a deposit of tubercular matter; on the contrary, I am satisfied that there is, in most cases, merely a tubercular diathesis, predisposing the part to the disease, and thus rendering it less capable of resisting its effects when once it is established. As in strumous ophthalmia there is often serious disease, and yet no evidence whatever of tubercular deposit, so in

strumous caries a bone may be completely softened and disintegrated, without any secretion of strumous matter, properly so termed. In both cases the diathesis exists, but not the tubercular matter. As this is the most frequent cause of caries, so is this form of the affection also one of the most difficult to remove.

*Morbid Anatomy.*—If a carious bone be subjected to careful examination, it will be found to exhibit marked differences in its appearances, according to the duration of the disease and the nature of the affected piece. In the earlier stages, the osseous tissue is merely inflamed, as is evinced by its vascular and softened condition; its spongy texture is rarefied, and occupied by a serous, oily fluid, intermixed with a good deal of the coloring matter of the blood, thus giving it a reddish aspect. It can be cut with the knife, or even indented with the finger, especially if the bone be a carpal or tarsal one, and, upon macerating it, the water soon becomes covered with a layer of fatty matter. Exposed to the air, it dries with difficulty, and assumes a pale, yellowish hue, verging slightly upon greenish. When the disease has reached its more confirmed stages, the bone is found to be excavated, or riddled with cavities, of variable size and shape, sometimes lined by a kind of pyogenic membrane, and filled with thin, sanious, and offensive matter, having none of the characteristic properties of laudable pus. Occasionally small fragments of bone lie loose in these cavities, being unable to escape on account of their disproportionate dimensions to the size of the opening in the surface of the affected piece. The osseous tissue is now extremely soft and brittle, breaking down readily under the finger; it is still more porous than before, and is of a grayish, brownish, or blackish color. It is apparently destitute of vessels, and gives out a considerable quantity of oily or greasy matter on maceration, the fat floating on the surface of the fluid. In many instances, however, the quantity of fat is very small, and the bone has rather a dryish than an unctuous appearance. In a chemical point of view, the only notable differences between carious and healthy bone is the greater amount of cartilage and fat in the former than in the latter, the quantity of cartilage often forming as much as thirty-seven per cent., while the amount of fat is upwards of three. This quantity of fat, although much greater than what exists in the normal state, is not sufficient to justify the opinion expressed by some that caries essentially consists in adipose degeneration of the osseous tissue.

The osseous tissue immediately around the softened and disintegrated structure is always more or less inflamed, being preternaturally red and vascular; the periosteum is thickened, spongy, and injected; and the endosteum exhibits all the phenomena of an active participation in the disease. The compact lamella has often a worm-eaten appearance, and it is not uncommon to find it partially incrustated with bony matter. The soft parts around are infiltrated with seroplastic matter, indurated, closely matted together, and otherwise altered. In articular caries, there is always more or less involvement of the cartilages, which are gradually softened and disintegrated, large pieces often coming away with the discharges.

The ravages of caries of the osseous tissue, consequent upon the

effects of tertiary syphilis, are well displayed in the annexed cut (fig. 5). The disease commenced in the soft palate, from which it gradually extended to the bones of the cranium and face, causing a free communication between the mouth, nose, orbits, and frontal sinuses. Fig. 6, from a specimen in my collection, affords a good illustration of caries of the head of a bone.

Fig. 5.



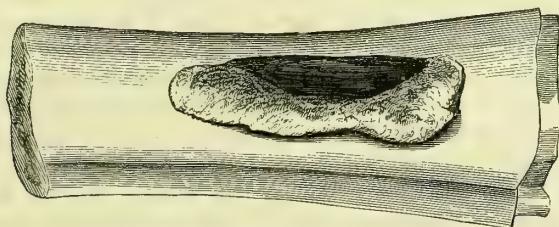
Fig. 6.



Caries of the head of the humerus.

*Symptoms.*—The symptoms of caries are usually obscure, especially in its earlier stages, the line of demarcation between it and osteitis being impossible to be determined. It is only when the affection has terminated in suppuration, ulceration of the soft parts (fig. 7), or the formation of sinuses, that its real character can be fully made out. Prior to this the surgeon may suspect the nature of the disorder, but he cannot by any means be certain of it. All the symptoms, in the

Fig. 7.



Caries of the tibia, showing an ulcer in the skin.

first instance, are those simply of osteitis. There is a dull, heavy, aching pain, which appears to be deeply seated in the substance of the bone, and which gradually increases in extent and severity with the progress of the morbid action; the part feels exquisitely tender to the touch; the skin has a glazed, reddish appearance, and there is marked tumefaction, which, though somewhat diffused in its character, is generally particularly distinct at the focus of the inflammation. The local phenomena gradually augment in intensity, the pain assumes a throbbing



bing disposition, the swelling becomes more pointed, and presently the loose, flabby integuments give way by ulcerative action, thus allowing the contents of the abscess—for such in fact the case now is—to drain off. The bone thus laid bare exhibits a foul and corroded aspect, at the same time that it feels soft and rough to the finger. If the examination be conducted with the probe, as it must be when the bone is deep-seated, the instrument will be found to pass very readily into its substance, which is already softened and partially disintegrated, a short time being generally sufficient to effect important changes.

The *sinuses* leading to the seat of the disease are either straight or tortuous, and vary in length from a few lines to several inches, according to the depth of the affected bone, and, above all, the place of opening of the resulting abscess. In general they are multiple, most of them opening by separate orifices, so as to give the surface a cribriform appearance. In chronic cases the sinuses are lined by a species of false membrane, and the situation of each is indicated by a mass of reddish granulations, somewhat mammillated in shape, in the centre of which the aperture of communication is generally easily detected with the point of the probe. This nipple-like body, which is often entirely insensible, and almost always smeared over with pus, projects considerably above the surrounding level, and is of great diagnostic value, as it is invariably denotive of carious or necrosed bone. The sinuses here described do not commonly all form at once; perhaps there may be only one or two at the beginning, the rest being superadded during the progress of the disease, or, perhaps, as one closes another appears. Whatever may be their mode of development, the parts around are more or less indurated, inflamed, and tender on pressure.

The *discharge* furnished by the affected bone is extremely variable; in general, however, it is of a thin, ichorous, sanious, or bloody character, loaded with earthy matter, extremely fetid, and so irritating as to erode the parts with which it comes in contact. It usually tarnishes silver—a circumstance which shows that it contains sulphuretted hydrogen gas—and is often so profuse as to cause serious exhaustion. The earthy matter is easily detected by its gritty character, by rubbing the fluid in while it is suspended between the thumb and finger, and frequently amounts to two per cent. of the entire discharge. Sometimes the pus is of a laudable nature, but when this is the case it may be assumed, as a general rule, that it is furnished by the adjacent soft parts rather than by the bone itself. Whatever its character may be, it is not uncommon for it to contain flakes of lymph, débris of cellular and aponeurotic substance, and even considerable fragments of bone and cartilage; the latter being most apt to show themselves when the sinus penetrates a neighboring joint.

The *constitutional* disturbance is not always proportionate, so far as we can judge, to the amount of the local disorganization. The general health is often but little affected, especially in the early stages of the disease; by degrees, however, it begins to give way, and ultimately it always suffers severely, the patient losing flesh and strength, the countenance becoming wan and pallid, and the sleep and appetite



being destroyed. If the disease is at all extensive, or if, even when it occupies but a small compass, it opens into a large joint, as, for example, the knee, hectic irritation soon sets in, and making rapid inroads upon the system, speedily reduces the patient to the very verge of the grave. The pain is often excruciating, particularly at night and in damp states of the atmosphere, and is one of the principal sources of exhaustion.

*Diagnosis.*—The diagnosis of caries can only, in general, be determined by a careful consideration of the history of each individual case. Until ulceration of the soft parts occurs, the nature of the disease must almost necessarily remain an enigma. The only affection with which it is liable to be confounded is necrosis, from which it may generally be easily distinguished, before the skin has given way, by the comparatively small amount of pain attending it, as well as by the lesser degree of constitutional disturbance, and by the fact that caries is usually met with in the short bones, while necrosis mostly occurs in the shafts of the long. When sinuses have formed, the eye, finger, and probe will usually be able to determine the diagnosis, by the appearance and feel of the affected structure. In both cases the bone is roughened, but usually much more so in necrosis than in caries; in the former it always retains its original consistence, whereas in caries it is so much softened as to be readily penetrated by the probe. Nothing of a definite character can be learned from the nature of the discharge, since it is nearly identical in the two maladies. Occasionally valuable information may be obtained from a consideration of the exciting cause. Thus, osteitis from syphilis terminates more frequently in necrosis than in caries, the reverse being the case when the inflammation is dependent upon a scorbutic or strumous taint of the system. To this statement, however, numerous exceptions occur, and the diagnosis must, therefore, at least in most cases, be a matter of time and of repeated critical examinations.

*Prognosis.*—The prognosis of caries is generally unfavorable, a spontaneous cure, although not impossible, being an extremely uncommon occurrence. When the disease is of limited extent, a cure may often be promptly effected by operative measures directed against the affected parts, but under opposite circumstances nothing short of resection or amputation holds out the slightest prospect of relief. In many cases the affection continues for years, apparently neither advancing nor materially receding, the general health in the meantime experiencing but little change; on the other hand, however, its progress is sometimes very rapid, and the constitutional disturbance proportionably great, hectic irritation, loss of strength, and emaciation setting in early, and steadily proceeding until the patient dies completely exhausted. As a general rule, it may be stated that caries is less likely to terminate favorably when it assails the vertebræ and the articular ends of the long bones than when it appears in any other portions of the skeleton, except, perhaps, the carpal and tarsal bones, in which the malady is often so extremely obstinate as to require the removal of the limb in order to save life. The prognosis is, of course, other things being equal, more unfavorable in sickly and debilitated

persons than in such as are healthy and robust at the time of the attack.

*Treatment.*—The treatment of caries, notwithstanding the modern lights of pathology and therapeutics, is extremely unsatisfactory, if not entirely empirical. That it should always, if possible, be conducted with strict reference to the nature of the exciting cause, whatever this may be, is a self-evident proposition. When the disease has been induced by a syphilitic, strumous, or scorbutic taint of the system, remedies calculated to meet these respective contingencies will of course promptly suggest themselves to the mind of the practitioner, as most likely to fulfil the particular indication of the case; but where no such affection is visible, and where, in fact, nothing whatever of an appreciable character exists, he must disregard all rules, and limit himself to the application of general principles. In all instances, whether the disease be owing to constitutional or local causes, great care should be taken to combat inflammation, by the observance of the most perfect rest, to give vent to effused fluids, and to remove any fragments of bone as soon as they are sufficiently detached to warrant such a procedure. Among the general means, a properly regulated diet is one of the most important; it should be perfectly plain and simple, but at the same time nutritious, so as to build up the system, and create a better state of the blood, which is generally so much at fault in caries of nearly all portions of the skeleton. Chalybeate tonics, quinine, nux vomica, and cod-liver oil are the most valuable internal remedies; aided, as occasion may seem to demand, by blue mass and alkalies, to modify and improve the secretions. Much purging must be avoided, as it would inevitably prove prejudicial by its debilitating effects. Exercise in the open air is often of great service, but to render it efficient care must be taken not to move or irritate the diseased bone while it is being employed. Salt bathing, followed by dry friction, will be of benefit in imparting tone and vigor to the cutaneous capillaries; and in many cases the general health is immensely improved by a residence at the sea-side.

In commencing the *local treatment*, the first object should be to allay the irritation of the soft parts by attention to rest and position, and by the application of leeches, fomentations, and poultices, or warm water-dressings, medicated with laudanum and acetate of lead. When there is much induration from plastic deposits, the skin should be freely painted twice a day with the dilute tincture of iodine, and if the case prove obstinate a large blister should be used, experience having shown that, in superficial caries, this is more effectual in arresting the inflammation and bringing on the suppurative crisis than any other remedy. Even in deep-seated caries it frequently answers an excellent purpose, promptly arresting the excessive pain, and promoting the absorption of effused fluids. As soon as evident fluctuation exists, or even before, if there be inordinate tension and throbbing, a free incision should be made, extending, if possible, into the very depths of the bone, so as to admit of the most thorough drainage. To allow the matter to be pent up for days and even weeks, as often happens in the hands of timid practitioners, must always prove excessively injurious, from the tend-

ency which the fluid, under such circumstances, has to burrow among the surrounding structures, detaching them from each other, and leading, in the end, to the formation of numerous sinuses. Besides, the early evacuation of the matter greatly abridges the suffering, constitutional as well as local, and thus prepares the system better for the future struggle. I have never seen a case where the retention of pus, whether among the soft parts, in the osseous tissue, or within a joint, has been productive of benefit; it always acts as a foreign substance, maintaining local and constitutional irritation, and hence I never hesitate to get rid of it as promptly and effectually as possible. These remarks are applicable to caries both of the superficial and deep-seated pieces of the skeleton. When the matter is pent up in the interior of a bone, as, for instance, in the articular end of the femur or tibia, evacuation should be attempted with the trephine.

The means now described are all merely of a palliative nature; they relieve pain, swelling, and constitutional disturbance, but are entirely incapable of curing the disease, however slight. To fulfil this indication other remedies are necessary, and these may be arranged under two heads, those, namely, which are used with a view of modifying the affected tissues, so as to afford them an opportunity of regaining their normal characters, and those which are resorted to for effecting riddance of the diseased bone, either in part or in whole.

Under the first of these heads are to be mentioned various *detergent* and acidulated preparations, as the solutions of the chlorides, creasote, nitrate of silver, and acetic, nitric, and hydrochloric acid, their strength varying with the age and constitution of the patient, and the state of the parts, the contact being effected by means of a large glass syringe, two operations being sufficient in the twenty-four hours. The chlorides are particularly serviceable in these cases on account of their cleansing and deodorant effects, while the acids act more directly upon the osseous tissue, stimulating the capillary and absorbent vessels, and thereby promoting a more healthy tone, at the same time that they produce disintegration of the earthy matter of the diseased bone. These remedies, and all others of a kindred nature, are certainly not without some benefit in the milder and more accessible cases of caries, but they all have the disadvantage of being difficult of application, as well as uncertain in their results, and can rarely be relied upon for a cure. I have, therefore, of late years, entirely abandoned their use with this intention, and now employ them only with a view to their detergent and deodorant effect, preferring, of course, the chlorides to any of the other articles for this purpose.

The *actual cautery*, formerly so much vaunted in the treatment of certain forms of caries, especially in that of the carpal and tarsal bones, is obnoxious to the same objections as the remedies just mentioned. In applying it, it is necessary not only to divest the affected bone pretty thoroughly of its soft parts, but to employ the greatest circumspection, otherwise a much larger amount of tissue may be destroyed than is desirable. Moreover, the eschar is always a long time in coming away, and the iron has generally to be used again and again before a cure is finally effected.



Under the second head are included the *operations* necessary for scraping or cutting away the diseased structure, excising the affected bone, either in part or in whole, and amputating the affected limb, when the case is unmanageable by other means.

As a general rule, all operative interference, having for its object the removal of the carious matter, is carefully abstained from until the disease has become strictly chronic, or, in some degree, ceased to spread. If this injunction be disregarded, injury, and not benefit, will be certain to follow our efforts, the irritation excited by them giving new impetus to the morbid action. The precise time for interference cannot, of course, be specified, but it is evident that no attempt should be made to scrape or cut the bone so long as the superimposed parts are in a highly tender, tumid, and inflamed condition. The proper treatment, under such circumstances, consists in the use of leeches, medicated fomentations, and other antiphlogistic measures calculated to soothe the irritated structures, and prevent the spread of the disease.

When the caries is of small extent, it may generally be got rid of by means of a burr-head drill, similar to that used by the dentist for removing caries from decayed teeth previously to plugging. With such an instrument, of which the adjoining sketch (fig. 8) affords a good idea, the whole of the diseased substance may often be cut away in a few minutes, with little pain to the patient, and no detriment whatever to the neighboring parts, which should always be turned aside immediately prior to the operation, care being taken in doing so not to interfere with any important structures. Every bone-case should have from three to six drills, of varying size and shape, so as to meet every contingency that may arise in practice. Several trephines, pliers, gouges (fig. 9), chisels, and scrapers (fig. 10),

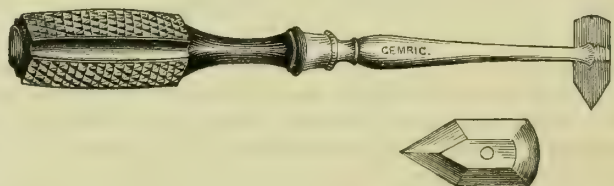
Fig. 8.



Fig. 9.



Fig. 10.



should also be at hand, and, when this is the case, it is difficult to conceive how any surgeon could fail in accomplishing his object. In operating upon the tarsal and carpal bones, I have generally derived material service from the use of a short, stout scalpel, with a semi-sharp convex extremity, and a large handle. Such an instrument is peculiarly advantageous in paring the surface of deep-seated cavities. When the ligaments and cartilages are involved, the operation can



hardly be completed in a satisfactory manner without a pair of blunt-pointed scissors, with long, thick, narrow blades. The raspatory is useful in smoothing carious cavities after the removal of the disorganized substance. During the operation, the diseased cavity is kept free from blood by means of sponge-mops.

When all the diseased structure has been removed, free use should be made of the syringe in order to effect thorough clearance of the affected cavity. Unless this be done, more or less of the bony matter will be left, thus keeping up irritation and discharge, and interfering with the reparative process.

Considerable *hemorrhage* often attends these operations, the blood sometimes proceeding from small arteries, but more generally from numerous points, as if it came from the pores of a sponge. In the former case, the ligature will usually be required, more particularly as the vessels are unable to retract on account of the indurated condition of the surrounding parts, while in the latter the temporary application of the sponge, wrung out of cold water, will commonly speedily arrest the flow. Should this, however, not answer the purpose, the bleeding cavity should be stuffed with lint, soaked in a strong solution of alum, or persulphate of iron, the plug being retained no longer than may be absolutely necessary.

Doubt is often experienced, in these operations, as to the amount of substance to be removed, the precise line of demarcation between the sound and diseased structures not being always easy of determination. A good diagnostic, under such circumstances, is to wash the fragments in water, when, if they be carious, they will exhibit a whitish, grayish, greenish, or blackish appearance; whereas, if they are healthy, they will be found to be vascular and red, and to retain their normal consistence, presenting none of the fragile and porous characters which distinguish them in the former case.

Bleeding having been arrested, the edges of the wound are loosely approximated by suture, and the limb, placed in a favorable position for drainage, is wrapped up in a bandage, extending from the distal extremity upwards beyond the seat of operation. Water-dressing is afterwards used, either cold or warm, as the case may seem to demand, and strict attention is given to antiphlogistics generally. Occasionally it is found requisite to insert a tent, to conduct off the matter, and prevent premature closure; and for some time the bony cavity should be injected twice or thrice daily with tepid water and Castile soap, or some gently detergent lotion. The great dangers after the operation are erysipelas and pyemia, which it is only necessary to mention in order to put the practitioner upon his guard respecting their occurrence.

The *healing process*, after such an operation, exhibits itself by the development of granulations, which, under the microscope, display very much the same appearance as those of the soft parts. The vessels, as shown in the annexed sketch (fig. 11), by Dr. Packard, have a remarkably looped and varicose arrangement. The drawing was taken from an ulcerated patella, which was covered with an immense number of the most beautiful scarlet granulations, not as large as the smallest

Fig. 11.



Structure of a granulation in a bone.

pin's head, closely grouped together, and exceedingly tolerant of rude manipulation. The section was magnified sixty diameters.

*Excision* of an entire bone is sometimes necessary for the relief of this disease. Such a procedure is most frequently required on account of caries of the carpal and tarsal bones, upon which it may frequently be performed with great advantage, a useful limb being generally left even after the removal of several of these pieces. In the long bones, the operation is usually limited to the arti-

cular end, or to this and a portion of the shaft. Respecting the manner of executing this operation, and the estimate to be placed upon it, in a curative point of view, special mention will be made in the chapter on resection, so that any further discussion of the subject here will be unnecessary.

When the disease is so extensive as to be uncontrollable by the means now described, and the attendant discharges are so copious as to give rise to profuse night-sweats, marasmus, and colliquative diarrhoea, *amputation* of the limb, comprising the carious bone, will afford the only chance of safety, and should be performed without delay. It is surprising how the system usually rallies after such an operation. The patient, in the course of a few days, generally looks like a new being; his sweats and diarrhoea soon leave him, and he rapidly improves in health and spirits, making often an excellent recovery.

#### SECT. VI.—NECROSIS, OR MORTIFICATION.

The word necrosis denotes the death of a bone, and is strictly synonymous with mortification, gangrene, or sphacelus, used to designate the death of a soft structure. The immediate cause of the occurrence is inflammation, eventuating in an arrest of the circulation and innervation of the osseous tissue.

Necrosis is most common in those bones which are most superficial, or which lie immediately beneath the integuments, as the tibia, ulna, lower jaw, clavicle, the inferior portion of the femur, and the phalanges of the fingers. The long bones suffer more frequently than the short, and the short than the flat, the reverse being the case in caries, for the reason that, in the former, the compact tissue is most commonly affected, and in the latter, the spongy.

Children under fifteen years of age, particularly such as are of a strumous diathesis or habit of body, are the most common subjects of this disease. This is more especially true of the idiopathic form; for traumatic necrosis probably occurs as readily in adults and old persons as in young. Of the influence of sex, climate, and occupation, upon

the production of the disease, nothing very satisfactory is known. If it be more common in boys than in girls, a circumstance, however, which has not been established, it is, probably, simply because the former are more exposed to the exciting causes of necrosis than the latter, and not because of any sexual peculiarity. It has been generally supposed, and not without reason, that the occurrence is most common in cold, damp, and variable regions; and the explanation of this seems to be that the inhabitants of these countries are particularly prone to suppression of the cutaneous perspiration, which, in individuals predisposed to disease, may, it is alleged, readily cause death of the more superficial bones. It has been ascertained that persons engaged in the manufacture of lucifer matches are liable to necrosis of the jaw, from the contact of the fumes of phosphorus with the interior of decayed teeth; and it is not improbable that there are other pursuits which may conduce to destructive inflammation of the osseous tissue, although of their precise nature and mode of action we are not informed.

*Causes.*—If we inquire into the idiopathic form of necrosis, we shall find, as has just been intimated, that it is most common in young strumous subjects, having well marked evidence of scrofula in other parts of the body, or, at all events, signs of a strumous predisposition, as evinced by the delicacy of the skin, the languid circulation, the tumid belly, and the deficient temperature of the extremities. I am certain that this has been the case in the great majority of the instances that have come under my own observation, and I believe that this, in the main, agrees with that of other writers. It is in persons of this description, more particularly, that we so frequently meet with the worst species of necrosis of the tibia, femur, and humerus, telling so fearfully upon the constitution, and so often requiring amputation in order to save the patient's life. The most common cause of the disease, in this class of subjects, is exposure to cold, as when a boy, overheated by play, sits down in a current of air, and thus suddenly repels his perspiration; or when, under similar circumstances, he strips himself, and plunges into cold water. He is not made aware, perhaps, for several days that he has received any injury; but, all of a sudden, he is seized with violent pain in one of his limbs, attended with severe rigors alternating with flushes of heat, and, upon examining the affected part, he observes that it is exquisitely tender on pressure, more or less swollen, and covered with an erysipelatous blush. The local and constitutional symptoms progressing, matter soon forms deep beneath the muscles, the swelling becomes more and more circumscribed, and, ulceration taking place, the contents of the abscess thus gradually find their way to the surface, leaving the bone dead below. Such is the manner in which necrosis is generally produced in weakly, scrofulous subjects, and it is hardly necessary to add that all the attendant phenomena are indicative of a rapidly destructive osteitis.

Tertiary syphilis is another cause of necrosis, and the history of this disease has shown that the osteitis growing out of it is more apt to occasion death when the patient has been subjected to free courses of mercury for its cure, than when the malady has been treated on general antiphlogistic principles. The two poisons coming together, and min-



gling their baneful influence, induce a form of ossific inflammation which is extremely prone, especially in persons of a worn-out, debilitated constitution, to terminate in gangrene of the bones, in particular those of the nose, palate, upper jaw, leg, and arm.

Protracted courses of mercury, especially in young subjects of a strumous diathesis, or exhausted by diarrhoea, cholera, or eruptive diseases, often cause necrosis of a frightful character, generally of the jaw-bones, but sometimes, also, of other pieces of the skeleton. What is termed dry salivation is frequently more destructive to the gums, teeth, and jaw-bones than salivation accompanied by profuse discharge. The debility produced by the injudicious use of drastic purgatives and tartar-emetic has occasionally caused necrosis of the bones of the extremities, head, and trunk. Scurvy has been known to produce similar effects, although more commonly it causes caries. In short, there is reason to believe that idiopathic necrosis may be induced by whatever has a tendency to bring about an impoverished condition of the blood and solids.

Among the local causes of necrosis may be enumerated wounds, contusions, fractures, and chemical irritants; in the tibia, the probability is that mere concussion, as happens when a person falls from a considerable height and alights upon his foot, is often sufficient to produce a destructive form of osteitis. Gunshot injuries are a common source of the occurrence, whether the bone be merely grazed by the passage of the projectile, or whether the ball lodge in its substance and acts as a foreign body. Mere denudation of a bone, however occasioned, is frequently followed by its death, especially when the loss of periosteum is very considerable, or if, even when it is comparatively trivial, it is accompanied by the laceration of the nutrient artery, or extensive destruction of the soft parts generally. Under such circumstances, the necrosis is usually limited to the outer compact structure, the part ultimately coming away in the form of an exfoliation. Such an event, however, is by no means inevitable. The periosteum may be stripped off to a considerable extent, and yet, if the bone be in other respects healthy, or enjoy a tolerably active circulation, granulations will spring up, and thus gradually repair the breach. It is only when the vascular connection between the two structures has been materially impaired, or totally destroyed, that necrosis will be likely to ensue, the bone becoming white and dry, and eventually dark and even black. These appearances are well illustrated in what so often happens in compound fractures, attended with protrusion of the end of the bone divested of its fibrous covering, and in the phalanges of the fingers in whitlow.

It will thus be perceived, without going into further details, that death of the osseous tissue may be produced by constitutional or local causes, and that these causes differ in no respect whatever from those which induce mortification of the soft parts. Furthermore, it will be observed that they are such as usually give rise to inflammation generally in all structures without exception.

*Extent.*—Necrosis may be partial or complete, simple, or complicated, superficial or deep; that is, it may affect merely a portion of a bone, or it



may pervade its entire structure; it is said to be simple when it is limited to a single piece, and complicated when it attacks several, either simultaneously or consecutively. It is seldom that an entire bone perishes. Such an occurrence is sometimes observed in the pieces of the carpus and tarsus, in consequence of external injury; but it is extremely uncommon in the long bones; in these the shaft alone generally suffers, the articular ends retaining their vitality. Necrosis of the whole lower jaw has been repeatedly noticed as a result of the action of phosphorus, and some interesting cases in which the entire bone was successfully removed on account of this disease have been related by Dr. Carnochan and Dr. James R. Wood. Finally, necrosis may be limited to the outer surface of a bone, involving merely its superficial laminae, the dead portion being ultimately detached in the form of a thin scale, or plate; or it may invade its entire thickness, and then not unfrequently begins in the very depths of the cancellated tissue, in consequence generally of injury or disease of the medullary membrane.

The occurrence of necrosis, the elimination of the dead bone, usually called the sequester, and the formation of new bone, as a substitute for the old, or that which has died, involve some very curious pathological and physiological processes, and therefore deserve attentive consideration. The symptoms which immediately precede, and those which accompany the death of the bone are such, generally, as are denotive of violent inflammation, deep-seated, attended with excruciating pain, and rapidly tending to the suppurative crisis, the mischief being often done in a few days, and sometimes even in a few hours. Action, general as well as local, is excessive, and both the part and system occasionally fall a prey to its devastating influence, especially when there is involvement of a large neighboring joint, as now and then occurs when the necrosis attacks the inferior extremity of the femur, and extends into the knee. Progress, however, is not always so swift and overwhelming; often it is quite the reverse, the part and system suffering but little, and the malady pursuing apparently a chronic course.

A very common way in which the occurrence of gangrene of a long bone is announced is as follows. The patient, usually a lad from six to ten years of age, after having been overheated, or exposed to severe cold, retires at night apparently perfectly well, but towards morning he is aroused by pain in the thigh or leg, deep-seated, circumscribed, of a sharp, aching character, and so excessively severe as to deprive him of further sleep and rest. The soft parts over the seat of the disease soon become exquisitely tender to the touch, swollen, and discolored, the surface having a glazed, dusky, reddish, or purplish tint, and pitting under pressure, in consequence of the infiltration of the subcutaneous cellular tissue. These local phenomena are always attended by severe constitutional disturbance. There is high raging fever, with a tendency to delirium, and excessive restlessness; the pulse is full, hard, and frequent; the skin is hot and dry; the thirst incessant; and the urine, thick and scanty, is surcharged with urates. By and by, violent rigors set in, succeeded by flushes of heat, the pain assumes a tensive, throbbing character, the swelling becomes more diffuse, extending often to a great distance up and down the limb, as well as

widely circumferentially, the discoloration acquires an erysipelatous blush, and a careful examination soon detects, what, indeed, the existing symptoms sufficiently declare, the presence of pus, deep-seated, lying partly between the affected bone and the periosteum, and partly on the outside of the membrane, in the cellular tissue of the muscles and aponeuroses, which it often extensively dissects and separates from each other, forming large pouches from which it is frequently difficult to dislodge it. Sometimes the abscess opens into a neighboring joint, and thus becomes a source of additional mischief, exciting inflammation in the synovial membrane, perhaps ultimately followed by destructive softening of the cartilage, and caries or necrosis of the end of the bone.

The quantity and quality of the matter found at this stage of the disease are very various. In the more severe cases it often amounts to several pints, whereas, under ordinary circumstances it may not exceed that many ounces. The quantity furnished by the bone itself, or, rather, by the bone and periosteum, is always comparatively small, most of it being supplied by the soft structures over and around the seat of the disease. In most cases of spontaneous necrosis, it is found to be of a decidedly strumous character, being of a yellowish color, verging upon greenish, and of a thick cream-like consistence, interspersed with tough curdy matter, or flakes of lymph. In general it is more or less fetid—sometimes excessively so, particularly when long retained—and mixed with shreds of dead cellular tissue. Cases are met with where the matter is thin, ichorous, or sanious, but such an occurrence is unusual until after the bursting of the abscess, and the evacuation of its contents.

When the matter has been discharged, whether spontaneously or artificially, there is always a material improvement in the symptoms, both local and general, and an opportunity is now afforded for a thorough examination of the parts. The best instrument for this is the finger, or, when the opening is not sufficient or too devious, the probe. With either of these it is generally easy to determine the extent of destruction of the periosteum, or, at all events, of its separation, and the amount of injury sustained by the osseous tissue, the surface of the bone feeling rough, and having a whitish, grayish, or ashy hue, without any appearance whatever of vascularity.

Such is a succinct, but, I believe, sufficiently accurate account of the circumstances which immediately precede, accompany, and immediately succeed the occurrence of necrosis as it is usually met with at the bedside. The first stage of the disease is over; the matter consequent upon the inflammation has been discharged; and the inflammation itself has measurably subsided, the soft parts, however, being still swollen, indurated, tender, and painful, as well as entirely disqualified for the performance of their normal functions. Nature, never idle, now begins the double work of elimination and repair, both usually very tardy, often imperfect, and sometimes altogether unsatisfactory, the powers both of the part and system being inadequate to accomplish the object. In gangrene of the soft structures, the separation of the eschar is generally an easy matter compared with that of a bone, provided the patient's strength holds out; the process, once fairly com-

menced, proceeds rapidly and energetically, the surgeon each day seeing decisive evidence of the fact; soon the line of demarcation between the dead and living parts is perceived; then granulations are observed to spring up in the intervening chasm; and, finally, the reparative efforts still advancing, the breach is gradually closed over with new skin, a circumstance clearly denotive of the completion of the cure. But it is altogether different in necrosis; here the detachment of the slough is a matter of time, commonly requiring many weeks, and sometimes even a number of months, for its satisfactory conclusion, and even then generally demanding the interference of art before it can finally be effected. The cause of the difference is sufficiently obvious. In the one case there is an active circulation and an energetic system of absorbents, the former furnishing an abundance of plastic material for the repair of the lost tissues, and the latter exerting themselves to cast off the dead substance; in the other, on the contrary, everything is the reverse, and the parts labor under the additional disadvantage of being loaded with earthy matter, which is obliged to be softened and disintegrated before it can be removed by the vessels whose duty it is to get rid of it.

The necrosed substance may, as already seen, embrace merely a portion of the periphery of a bone, as, for example, its outer layer; or it may include its entire thickness, and also the greater part of its length. In the former case it constitutes, when detached, what is called an *exfoliation*, and in the latter a *sequester*, a distinction of considerable importance, not so much on account of the extent of the dead substance, as of the manner in which the breach of continuity is repaired, or a new bone formed.

An *exfoliation* is commonly merely a thin scale, plate, or lamella of the outer, peripheral portion of a long bone, of variable color, and consistence. In general, it is either whitish, grayish, or of a light brownish hue, rough, more or less porous, and so brittle as to break under very slight pressure. No vessels are perceptible in it, and in most cases the animal matter seems to be almost completely abstracted. Maceration deprives it of its dark color, while immersion in dilute nitric acid for a few days completely destroys its proper texture, converting it into a soft, gristly substance.

The *sequester*, properly so called, varies much in size and shape, consisting, at one time, of a part only of the circumference or length of a bone, and at another, of its entire shaft, with perhaps a portion of its articular ends. A rather common form is that represented in the adjoining sketch (fig. 12) from a preparation in my collection; it was a part of the body of the tibia, in which all the spongy structure was completely destroyed, while the compact was remarkably hard and firm. The dead bone is always rough, pitted, excavated, or spiculated; it is of a grayish, brownish, or blackish color, and emits, when struck with a probe or

Fig. 12.



Necrosis of the tibia.



piece of metal, a peculiar hollow sound, by which it is usually readily distinguished from sound bone. In the cylindrical pieces, as in the femur and tibia, it is generally dense and dry; in the short and flat, on the contrary, it is porous, moist, brittle, and easily crumbled. The analyses of Von Bibra have shown that there is a very great reduction of organic matter in necrosis with a corresponding increase of earthy, the latter being as much as eighty per cent. of the entire mass. The same experimenter has proved that the difference is considerably less in the traumatic variety of the lesion than in the idiopathic.

*Reparation.*—While the absorbents are engaged in detaching the dead bone, with a view to its ultimate expulsion, the capillaries take upon themselves the duty of throwing out material for the formation of the substitute, or new bone. The process by which this is accomplished is the same as that which presides over the creation of the original structure. The first step consists in a deposit of plasma, the result of the incited action of the vessels caused by the irritation of the necrosed bone, and this substance, becoming organized, is gradually converted into fibro-cartilage, which, in turn, gives way to cartilage, as this ultimately does to osseous matter, the period required for the completion of the development varying, according to the age and vigor of the patient, and the character and amount of the local disease, from a few weeks to several months. The new bone is at first a mere shell encasing the old, and thus serving to separate it from the surrounding parts, which ill brook its presence. In time, however, it increases in thickness, being often from three to six lines in depth, and occasionally, though not generally, it is fully as large as the original piece. Its surface is usually somewhat rough, and it is not uncommon to observe upon it considerable eminences and depressions, owing evidently to the irregularity of the developmental process. The new substance, too, has comparatively little areolar tissue, and hence, if some time have elapsed since its formation, it always cuts with great difficulty, the resistance offered by it being much greater than that of the pre-existing structure. In cases of long standing, indeed, it often acquires the solidity and density of ivory, so that it requires great patience and perseverance to penetrate it with the saw and pliers. The vessels, under such circumstances, are always very small and sparse, and the Haversian tubes are traced with difficulty. In the long pieces, after the death and removal of the shaft, there is never a complete reproduction of the medullary canal and its lining membrane, or of the endosteum. In fact, the new bone, although it possesses all the essential attributes of the osseous tissue, is, nevertheless, a very imperfect type of the original, and hence much less capable of resisting the effects of disease and accident.

The appearances of the new bone, encasing the old or dead, are admirably depicted in the following cut (fig. 13), taken from a specimen in the collection of Professor Pancoast. Owing to the ravages of the disease, amputation became necessary.

In viewing the new bone as it surrounds the old, its surface is found to be pierced by several apertures, to which, from their fancied resemblance to the anus of a bird, the term *cloacæ* (fig. 14) is usually ap-



plied. These openings, which play an important part in the expulsion of the dead bone, owe their existence to a deficiency of periosteum, or of secreting structure, as is proved by the fact that, when the formation of new osseous tissue goes on uniformly round every portion of the periphery, the old bone will be completely imprisoned, thus not only obscuring the diagnosis but rendering the removal of the sequester a matter of great difficulty and perplexity. The size of these cloacæ varies in different cases, from that of a three cent piece to that of a quarter of a dollar, their shape being generally rounded, or somewhat oval. Not unfrequently, however, they present themselves in the form of long, irregular fissures, or slits. Their number is indefinite; sometimes there is but one, while at other times there are as many as half a dozen, the latter number being by no means uncommon in necrosis of the shaft of the tibia.

Whatever may be the size, form, or number of these apertures, they always communicate with the surface of the limb in which the affected bone is situated, the passages between them constituting so many channels for the discharge of matter and the ultimate elimination of the sequester, although this, owing to the inadequate dimensions of the cloacæ, is seldom effected without the intervention of art. It is an interesting fact, and one of no little practical value, that these openings are always situated in that portion of the new bone which is least covered by soft parts.

There has been much dispute among pathologists, as to the agents by which the new bone is produced, and the question can hardly be said to be even yet definitively settled. Without entering into any details, I may state, as the result of personal observation, that the perfection of the new bone will generally be found to be in the proportion to the integrity and activity of the periosteum. I have always found that, when this membrane has suffered much during the inflammation which precedes and accompanies the necrosis, the reproductive process, or new osseous epigenesis, is always tedious and difficult, and often extremely inadequate, the new bone being comparatively small and stunted, and, therefore, ill adapted to the purpose of a substitute bone. The part which the periosteum plays in the development of the new bone is well shown in the formation of cloacæ, which, as already stated, is clearly dependent upon the partial destruction of

Fig. 13.



Necrosed tibia, the  
dead bone lying  
loose within the  
new.

Fig. 14.



Cloacæ in a ne-  
crosed tibia.

that membrane. If the periosteum everywhere retained its integrity, the new bone would be without a solitary opening, and the consequence would be that the sequester, or slough, would always be an encysted or imprisoned body. When this membrane has perished along with the bone, as occasionally happens in the shaft of the tibia or femur, the new bone will be formed by the surrounding structures, whatever these may be, but under such circumstances it is so imperfect, short, and thin, as hardly to deserve the name of substitute, to which, in general, it is so well entitled.

When the eschar presents itself as an exfoliation, or thin superficial scale, the breach is repaired through the medium of granulations, which, being derived from the old bone, are extremely vascular and sensitive, and soon assume the ossific process, throwing out an abundance of proper material for the accomplishment of the object. A similar process appears to be set up when the central portion of a bone perishes; for here the endosteum being also destroyed, can have no agency in the reproductive act. When this membrane retains its vitality, it is reasonable to suppose that it would exert an important influence as an epigenetic agent.

The idea has been broached, and warmly defended, that when the shaft of a bone is necrosed, so as to leave merely its articular ends, the new bone is formed exclusively by these ends, the osseous matter extending gradually towards the middle of the chasm, and ultimately coalescing there. Such a theory, however, is altogether untenable, being contrary to what occurs in the growth of the original bone, which always takes place by several distinct points, one of which is invariably central. However well the surviving extremities might perform their duty, yet, as there is no central nucleus, serving as a point of departure for the ossific matter, it is easy to conceive that the bone would always necessarily be so deficient at that particular spot as to disqualify it materially for the performance of any useful functions.

*Symptoms.*—The symptoms which attend necrosis, in its earlier stages, have already been pointed out; those which accompany the separation of the old bone and the formation of the new, are, in general, sufficiently characteristic. The most important of these are, little ulcers, surrounded by large unhealthy granulations, arranged in a papilla-like manner; sinuses leading from these ulcers down to the dead bone; and a discharge, more or less constant and copious, of thin, fetid, sanious matter, or of thick, white, inodorous pus; accompanied, in all cases, by a certain amount of hardness and swelling, pain and tenderness on pressure, wasting of the soft parts above and below the seat of the disease, and marked impairment of the functions of the neighboring joints. The general health always suffers; the patient is wan and emaciated; and, if the irritation is at all extensive, he will usually have hectic fever. In some cases the end of the sequester sticks out at one of the cloacæ, thus at once declaring the real nature of the complaint; but more commonly the dead bone is completely imprisoned by the new, and can only be reached by the probe or finger, carried along the sinuses leading from the surface to the cloacæ. In order to ascertain whether the separation has been effected, or whether the dead

bone still maintains its relations, in some degree, with the living, the surgeon may often advantageously use two probes, introducing one at each extremity of the eschar, and moving them alternately in different directions, as may frequently be easily done when the detachment is complete. In general also useful information, in this respect, may be obtained from a consideration of the history of the case, as the size of the affected bone, the age of the patient, and the commencement of the attack. Thus, other things being equal, it will usually be found that a small bone will be more readily separated than a large one, and the bone of a young subject than that of an old one, while in every instance the process may be supposed to be more advanced in proportion to the period that has elapsed since the death of the bone.

*Prognosis.*—The prognosis of this disorder is variable. In general, it may be considered to be favorable when it is owing to external or local causes; when it is confined to the outer portion of a bone, the necrosis occurring in the form of an exfoliation; when it is simple and of moderate extent; and when the patient is young, robust, and of a good constitution. On the other hand, the cure is difficult, and the issue doubtful, when the disease is extensive and complicated with other affections; when it attacks pieces which are of high importance on account of their functions, or situation; when it occupies the interior of a bone, and involves several parts of it; when it arises from an internal or constitutional cause, as struma or syphilis; when it extends into the adjacent joints, especially when these joints are of large size; and, lastly, when the patient is enfeebled by age, long suffering, or previous disease.

The time required for the development of the substitute bone will depend, as already stated, in great measure, upon the situation and extent of the disease, the age, health, and condition of the patient, and various other circumstances which will readily suggest themselves to the reader. That the whole of a necrosed bone may be regenerated, is a fact so well established as no longer to admit of any doubt. The new bone, however, as intimated elsewhere, is always, at best, only an imperfect copy, although, as it respects its functions, it usually answers the purpose well enough.

*Treatment.*—The treatment of necrosis must of necessity depend very much upon the circumstances of each particular case. There are three indications, however, which deserve special attention, the first of which is to limit and moderate the inflammation which is the immediate cause of the mischief, the second, to watch nature during the separation of the old bone and the formation of the new, and the third, to promote the removal of the sequester, slough, or eschar.

The first of these objects, which should always be kept clearly in view by the practitioner, is to be attained, of course, by the proper employment of antiphlogistic remedies; by the lancet, if the patient be plethoric, purgatives, the antimonial and saline mixture, light diet, repose, and the free use of opiates to allay pain and induce sleep. The affected parts, placed in an easy, elevated position, are leeches and fomented, or, what is particularly serviceable, painted with a strong solution of iodine at least three times in the twenty-four hours, the



surface being protected in the intervals with an emollient anodyne cataplasma, or medicated water-dressing. In some instances, great benefit is derived from the application of a blister large enough to encircle nearly the whole of the affected limb, and kept on sufficiently long to produce thorough vesication. By these means, the surgeon not only limits the inflammation, but promotes the absorption of effused fluids, and hastens the suppurative crisis, which is always inevitable, to a greater or less degree, in every case of this kind. As soon as fluctuation is perceived, or even before, if there be inordinate pain and tension, or deep-seated matter, a large incision is made at one or more points, in the direction of the long axis of the bone, in the hope of saving osseous tissue as well as soft, especially the periosteum, the integrity of which is so essential to the development and formation of the substitute bone. In making the opening, due attention is, of course, had to drainage, and to the prevention of its premature closure.

The second indication is to watch the part and system during the sloughing process and the stage of reparation, in order that they may be enabled to perform with facility the arduous and important duties before them. The case requires active vigilance rather than active treatment; care, on the one hand, that the disease do not spread, and, on the other, that the debility consequent upon the drainage and irritation do not obtain the mastery, and so bring on fatal exhaustion. A certain amount of inflammation must necessarily attend both processes, and, therefore, action must not be too much repressed, lest nature be thwarted, or, at all events, embarrassed in her operations, operations which are both salutary and needful. A nutritious diet will generally be required, and the patient will often be immensely benefited by animal food and milk punch, ale, porter, or wine, and the use of quinine, iron, and aromatic sulphuric acid, especially if he have hectic fever and night-sweats. If he can move about on crutches, he should take gentle exercise daily in the open air; or, if this be impracticable, he should be pulled about in a hand-car, or be swung upon a hammock. Attention is, of course, paid to the bowels and secretions. Pain is allayed by anodynes. The principal local remedies are leeches, provided there is any disposition to over-action, the daily application of iodine, and the use of the bandage to support not merely the affected parts but also the distal portion of the limb, which, when this precaution is neglected, has usually a tendency to become œdematous. Fœtor is allayed, and discharge moderated, by the chlorides, introduced by the syringe and sprinkled upon the dressings. Much has been said about the employment of solvents, thrown through the principal sinuses upon the dead bone, in the vain hope of promoting its gradual disintegration and elimination. Special stress used to be laid upon various acid solutions, particularly the nitric, hydrochloric, and pyroligneous; but experience has proved that they are always productive of harm, from their irritating effects upon the new bone and the soft parts, whilst, unless they are intolerably strong, they can exert no destructive influence whatever upon the sequester itself. If such lotions be employed at all, they should, therefore, be employed in the mildest possible form,



simply with a view to their detergent and alterant effects, which are often very salutary, expediting the sloughing and restorative processes. In general, however, all the good that can be expected to result from such remedies may be accomplished by injections of tepid water, impregnated with Castile soap, a little potassa, or common salt, followed, if there be much fetor, by a weak solution of chloride of soda. If new abscesses form, as occasionally happens, they must meet with prompt attention.

During this stage, a stage, I repeat, of comparative inactivity, inquiry is made into special diatheses, or states of the system. The patient may be strumous, and, therefore, be in need of anti-strumous remedies; or his system may be impregnated with the syphilitic poison, and a course of mercury, or of iodide of potassium, may be required. It must be obvious that no satisfactory progress can be made, in any case, towards a cure so long as the system is borne down by the pressure of a vitiated state of the solids and fluids.

The third indication is to get rid of the sequester, for so long as this remains it must necessarily act as an irritant, keeping up inflammation and discharge in the parts with which it lies in contact. It was generally supposed, until recently, that the dead bone, during its sojourn among the living tissues, was acted upon by the absorbent vessels, so as to diminish, more or less, its size and weight, the idea having apparently derived support from the altered and pitted condition of the surface of the affected piece. The notion, however, has been completely dispelled by the experiments of Mr. Gulliver, who ascertained, as might, indeed, have been anticipated, that such an occurrence is altogether impossible. Pieces of necrosed bone, carefully weighed before and after exposure, were confined on suppurating surfaces, in the medullary canal, and in the subcutaneous cellular substance for months, and in one instance for upwards of a year, without undergoing the slightest alteration whatever. A paper, detailing nineteen experiments of this kind, may be found in the twenty-first volume of the Transactions of the Medico-Chirurgical Society of London.

Seeing, then, that the dead bone acts as an extraneous body, and that it is in nowise amenable to the agency of the absorbents, the indication plainly is to remove it by operation. Such a step is the more imperative because of the manner in which it is imprisoned, the substitute bone forming a firm and solid case around it, and thus effectually preventing its extrusion. The only circumstance which should make the practitioner at all hesitate, is the doubt which may arise in his mind respecting the probability of the dead bone being completely detached, and the new one sufficiently advanced to enable it, after the removal of the sequester, to maintain its position without bending under the weight of the limb, in turning in bed, walking, or sitting. If he is satisfied of this, as he usually may be after a careful examination of all the facts of the case, he should at once proceed to adopt measures for the accomplishment of his object. The instruments which will be required for this purpose are various; but, in general, it will be necessary to have several scalpels, a trephine, a Hey's saw, an

elevator, pliers, chisels, and stout forceps, with a good syringe for washing away the osseous débris after the operation is over. The adjoining cuts represent some of the more important of these instruments.

Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18.

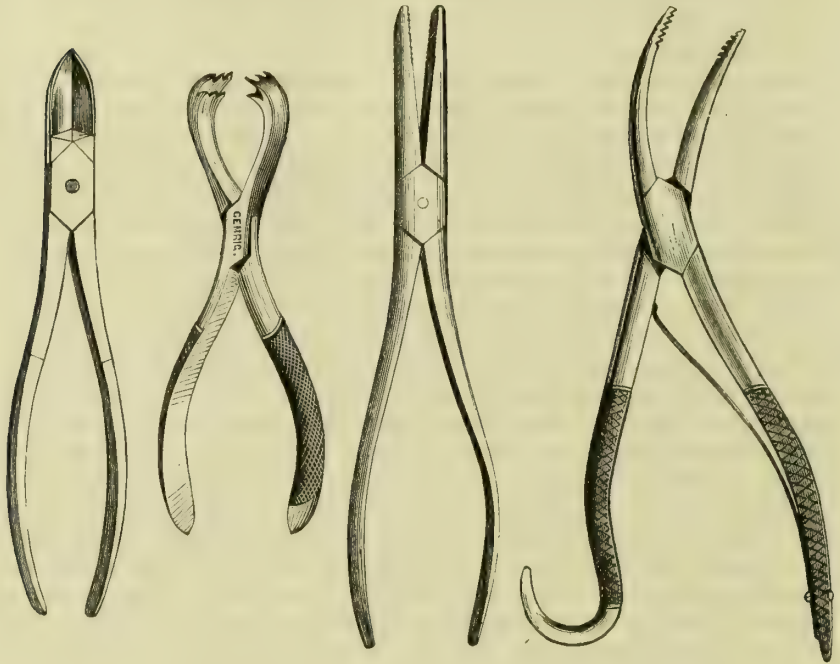


Fig. 19.



The incisions should always be made in the direction of the long axis of the bone, out of the way of the great vessels and nerves. The best plan usually is to select one of the principal cloacæ, or, when two or three are close together, especially if they be on the same plane, to connect them, thereby affording more room to work in. When the soft structures are much diseased, they may be included in an elliptical incision, as, in this event, it may be best to get rid of them. When it is deemed advisable to connect two or more cloacæ, the object may be easily attained by a Hey's saw, or, if the new bone is not very thick and firm, by the pliers. The trephine is chiefly of use when the openings in the substitute bone are very small, or when this bone possesses unusual density and thickness, rendering its division extremely difficult by the more ordinary instruments. Access having thus been obtained, the sequester is to be seized by one of its extre-

mities, with a pair of forceps having long, thin blades, serrated on their inner surface, and from a third of an inch to half an inch in width, the handles being well curved, so as to facilitate prehension and maintenance.

When the sequester is unusually long, it may be necessary to divide it at the middle, and extract each piece separately; an operation which is always easily performed with the pliers or chisel.

The dead bone having been extracted, the next step is to wash out the canal left by its removal with a few syringefuls of cold water to clear away any little pieces, fragments, or débris that may have been left. Attention to this injunction, although generally neglected, will greatly expedite recovery by facilitating the growth of healthy granulations. The hemorrhage attending the operation is often quite free, the blood oozing out at every point, in consequence of the great vascularity of the parts, both osseous and soft, and occasionally requires plugging of the cavern with lint steeped in some styptic lotion, as a saturated solution of alum, or alum and tannin. It is not often that any artery requires to be tied.

The operation being completed, the edges of the wound are drawn lightly together with adhesive strips, and the limb, placed in an easy position, is bandaged from the distal end upwards, the parts more immediately affected being kept constantly wet with cold water, or a weak spirituous lotion. The dressings are removed in forty-eight hours, when the wound is well syringed, and covered with an emollient poultice, to favor the granulating process. The only general means usually required are light diet and a little attention to the bowels, with a full anodyne after the patient is put to bed. If the new bone is not sufficiently strong to prevent the limb from bending or breaking, it must be supported by appropriate splints, or, what is better, a case made of sole-leather, gutta-percha, or trunk-maker's board.

Soon after the sequester has been removed, whether by nature or art, the new osseous shell begins to contract, and by degrees assumes the shape of the old bone, which it is designed to replace. While this change is going on externally, osseous matter is deposited upon the inner surface of the shell, as well as upon the articular ends of the surviving portions, thereby gradually filling up the cavity, the period required for this being generally in proportion to the size of the eschar. The medullary canal, in case of there having been one, is, as already stated, seldom re-established.

It is not often, at the present day, that, with proper management, the practitioner is not able to effect a cure in necrosis; in general even with little deformity or loss of function. Cases do, however, occur, where, in consequence of neglect or injudicious treatment, the neighboring structures are so extensively and ruinously involved as to render it difficult, if not impossible, to save the patient without sacrificing the limb. Such an event will be particularly liable to happen when a large joint is implicated, as, for instance, that of the knee in necrosis of the thigh, or of the ankle in necrosis of the tibia. Under such circumstances, hardly anything short of amputation will be likely



to answer; and a similar procedure may become necessary when the patient's constitution is so much shattered by previous or concomitant disease as to preclude the possibility of its holding out during the time which may be required for the separation of the dead bone from the living. In other cases, again, amputation may be demanded on account of hemorrhage from some large sinus presenting itself either as a general oozing, or as a flow from a considerable sized artery, opened by ulcerative action, under circumstances when the loss of a few more ounces of blood might prove fatal. It is impossible, however, to exercise too much caution in attempting to decide so grave a question. In weighing the several points involved in its consideration, we must not lose sight of the fact that cases, apparently of the most forlorn character, where life literally hangs, as it were, by a thread, will sometimes promptly recover upon the removal of the dead bone. Finally, it must not be forgotten that excision of an entire bone has often been advantageously performed, especially of late years, recovery taking place with comparatively little deformity.

#### SECT. VII.—SOFTENING.

The essential characteristic of osteomalacia, or softening of the bones, is a diminution of the firmness and solidity of the osseous tissue, depending upon the gradual removal of its earthy constituents, and the deposition of a reddish sero-albuminous, oily, or greasy substance. The malady is often confounded with rachitis, but differs from it in the circumstance, first, of its being a disorder of adult life; and secondly, in being always attended with severe pain; whereas rickets is peculiar to infancy, and free from local suffering.

*Extent.*—Softening of the osseous tissue varies in degree and extent, occurring at one time as a very slight affection, with hardly any appreciable change of structure, and at another as a most serious lesion, in which it is difficult to distinguish any trace of the normal substance. In regard to its extent, it may be general or partial, in the one case

pervading the entire skeleton, while in the other it is limited to particular bones, or portions of bone. Of general osteomalacia, the case of Madame Supiot (fig. 20), which has long since become classical, and which has been so minutely described by Morand, the younger, in the *Memoirs of the Academy of Sciences of Paris*, for 1710, affords a characteristic, as well as a most extraordinary example. This female, who was thirty-seven years of age at the time of her death, had her bones so completely softened that they could be bent like wax, and put in almost any position, although

Fig. 20.



Madame Supiot, in a posture quite practicable in the advanced stage of the disease.

she herself had lost all control over them, her head and left arm being the only parts she could move. Most generally the disorder is confined to particular bones, especially the ribs, sternum, vertebræ, and pelvic pieces.

*Morbid Anatomy.*—The osseous tissue in this disease gradually loses its firmness and solidity, becoming ultimately so soft and pliant that it may be easily bent, if not cut. It is of a pale reddish color, often inclining to yellow, is specifically lighter than the healthy structure, and is infiltrated with a turbid, viscid serum, removable by pressure. Occasionally the osseous fibres are widely separated from each other, so as to leave large cells, which are filled with a bloody-looking, adipose substance. When this is the case, the bone is sometimes remarkably pliant, bending like semi-concrete wax. Boiling completely dissolves it; and exposure to the air, by abstracting its moisture, sensibly diminishes its weight. Such are the principal changes observable in the osseous tissue. The periosteum over the affected part is abnormally thick, rough, and but feebly adherent; it is of a grayish hue, deeply injected, and, like the bone, infiltrated with sanguinolent matter. Upon being macerated, however, it is found to retain its fibrous structure. The marrow is converted into a reddish, greasy sanies; and the medullary membrane is wasted away to a few soft, cellular shreds. The cartilages sometimes participate in the softening, while the muscles are pale, atrophied, and infiltrated with a reddish fluid.

The softening generally involves the whole thickness of the bone; but cases occur in which the outer table remains unchanged, consisting of a thin, brittle shell. The disorder obviously consists either in an inordinate absorption of the phosphate of lime, upon which the solidity of the osseous structure naturally depends, or in a deficient deposition of this matter into its meshes. It has already been mentioned that the bones become specifically lighter in this disease; and Dr. Bostock has ascertained the additional fact that they contain nearly eighty parts of animal substance in the hundred. The experiments of this gentleman were afterwards confirmed by those of Dr. G. O. Rees, of London, who, from a careful analysis of three diseased specimens, taken from the same adult subject, obtained the following results, which he has compared with those furnished by healthy bone:—

	Diseased.		Healthy.	
	Earths.	Animal matter.	Earths.	Animal matter.
Fibula . .	32.50	67.50	60.02	39.98
Rib . .	30.00	70.00	57.49	42.51
Vertebra .	26.13	73.87	57.42	42.58

On examining this table, it will be observed that, in the diseased as well as in the sound state, the fibula contains more earthy matter than the rib, and the rib more than the vertebra. In health, the vertebra and rib approach very nearly in their proportions of animal and saline ingredients, whereas in softening a considerable difference obtains.

*Causes.*—What are the causes of this remarkable disease, or the circumstances which influence its origin and development? Upon this subject, unfortunately, science is almost completely silent. A great

variety of causes have been accused as being capable of producing it, more especially a gouty, rheumatic, syphilitic, or scorbutic state of the system; but, in admitting such an agency, it should not be forgotten that vast numbers of persons labor under such a taint, and yet are never the subjects of osteomalacia. That it may occasionally induce softening of the osseous tissue is extremely probable; but that this occurrence is frequent all experience plainly contradicts. The whole course of the disease shows it to be essentially connected with a vitiated and depraved condition both of the solids and fluids; but whether the disorder of the one precedes that of the other, or whether they have a simultaneous origin, and afterwards keep steady and regular pace with each other, are questions which our knowledge is inadequate to solve. However provoked, it is sufficiently apparent that the structures which are its seat are in a state of inflammation, and that this inflammation plays an important part in the production of the changes which characterize it. We cannot, as rational pathologists, assume any other ground; for, how else can we account for the excessive vascularity of the affected tissue, the sanguinolent nature of the infiltrated fluids, the thickened, spongy, and congested condition of the periosteum, and, finally, the atrocious and constant pains which form so notable a feature in the history of osteomalacia? All these circumstances unerringly point to inflammation as the great agent in the production of these changes; changes which, when existing in the soft structures, are invariably referred to this cause, and to none other. The morbid action, whatever it may be, is always of a chronic character, and is attended with important lesion of nutrition, leading to the removal of the earthy matter of the bones, and the excretion of it from the system, or its deposition among parts where it does not naturally occur. Or, what is more probable, there is both absorption of the original solid structure and a want of secretion of new, thus causing a complete disintegration, or decomposition, of the osseous tissue. All these circumstances are sufficiently obvious and tangible; but if we attempt to go beyond them, we involve ourselves at once in difficulties, from which it is found impossible to extricate ourselves.

*Age and Sex.*—Osteomalacia is rarely seen before the age of puberty; its favorite period of attack is between the thirtieth and fiftieth year. Another singular feature in its history is that it takes place much more frequently in women than in men, in the proportion, it has been said, of ten to three, but upon this subject it is obviously impossible to give any definite information. It is most common in females who have borne several children, and in a number of instances it has seemed to commence within a short time after parturition. Several cases have been reported where it was hereditary, having been distinctly traced through three generations, but in none of the offspring did it show itself until after puberty.

*Symptoms.*—The invasion and progress of this disease are generally very insidious. The earliest, and, for a long time, the most prominent, symptom is pain in the limbs, spine, and pelvis, of a wandering, shifting character, which the patient usually supposes to be of a rheumatic nature, and which is often so severe as to cause immense distress,



especially at night, and in damp, chilly states of the atmosphere. By and by, dyspnoea sets in, with palpitation of the heart, and a sense of constriction across the chest, and the patient is seized with an overwhelming feeling of prostration, which utterly unfits him for business, and usually compels him to keep his bed. If he attempts to walk his limbs bend under him, and if the effort be often repeated, they soon become badly curved; should his toe catch in the folds of the carpet, or should he be so unfortunate as to trip, or fall, or give his body a sudden twist, he will probably hear some of his bones crack, and yield under the superincumbent weight. Emaciation gradually takes place, the appetite is deranged, the skin is bathed with clammy perspiration, the tongue is foul, the bowels are irregular, being either costive or too loose, and the urine, surcharged with earthy phosphates, is very thick, heavy, of a whitish aspect, and frequently also albuminous. In the latter stages of the malady the saliva, tears, and sweat often contain similar ingredients. Great distortion frequently occurs, the bones bending in every direction, and thus effectually disqualifying them for the performance of their functions. The chest projects like that of a pigeon, the spine is bent laterally, as well as backwards, the pelvis is twisted, or rotated upon its axis, and the whole stature of the individual is sensibly diminished, the head being thrust down between the shoulders, which are unnaturally arched and prominent. Amidst all this disturbance, however, the intellect is unclouded, menstruation is perfect, and even conception is still possible. The period at which death occurs varies from a few months to several years, its approaches being usually very gradual, and the consequence of sheer exhaustion.

*Diagnosis.*—Osteomalacia is liable, as already stated, to be mistaken for rachitis. While it cannot be denied that the two diseases have several features in common with each other, it is equally certain that they possess sufficient points of dissimilarity to justify us in considering them as separate affections. The chief differences are the following: Osteomalacia is rarely seen before the age of twenty-five or thirty, while rachitis is altogether peculiar to infancy and childhood, the disease in the former attacking the bones after the completion of ossification, whereas, in the latter it assails them before they are fully developed. In softening, the patient is harassed with excessive pain and an overwhelming sense of exhaustion; in rickets, on the contrary, there is a total absence of pain, and the little patient generally retains a good share of strength. In osteomalacia there is more deformity than in rachitis; the disease is also of a more fatal character, few persons getting well, whereas in rachitis recovery is the rule, death the exception. Softening is much more common in women than in men, especially in such as have had several children; rachitis, on the contrary, is nearly equally frequent in both sexes. Finally, the two affections are signalized by marked differences in their anatomical character. In osteomalacia the osseous structure is completely disintegrated and decomposed; in rachitis, on the other hand, it is merely modified, and therefore susceptible of restoration.

*Treatment.*—The progress of osteomalacia can only be arrested by causing a change in the action of the secernent vessels, but as we

know of no means that are capable of doing this, all that can be done, in the present state of the science, is to endeavor to improve the general health by a well regulated diet and the employment of tonics, as iron and quinine, the shower bath, and change of air. Mercury has occasionally been administered, and carried to the extent of ptyalism, but, instead of proving beneficial, it has generally been productive of injury by still further exhausting the powers of life. Phosphate of lime, as having a tendency to supply the deficiency of osseous matter, has also been tried, but apparently with no better effect. If we adopt the idea that the disease is of an inflammatory nature, antiphlogistics ought to be advantageous, but thus far their employment has yielded no good results, but rather the reverse. When the disease is fully established, confinement in the bed or upon a soft elastic mattress will be necessary, and every precaution should be taken to avoid the occurrence of curvature and fracture of the affected bones. Pain must be relieved by the liberal use of anodynes.

#### SECT. VIII.—RACHITIS.

Rachitis, or rickets, is a disease of the osseous tissue, consisting in a deficiency both of its earthy and organic elements, as is shown by the diminished quantity of phosphate and carbonate of lime, and the absence of chondrin and gelatin, which form such important constituents of normal bone. The consequence is that the different classes of

Fig. 21.



Rickets.

bone—the long, short, and flat—become so excessively softened as, in time, to yield under the slightest pressure, bending and twisting in various directions, and thus occasioning serious and generally irremediable deformity, as observed in the drawing (fig. 21), taken from a patient in the Philadelphia Hospital.

Rickets is emphatically a disease of early infancy, being most frequently witnessed from the eighteenth to the twentieth month, although many cases occur before the end of the first year. Now and then an instance is observed as late as the twelfth year; but this is extremely uncommon, and altogether contrary to the usual course of the affection. Occasionally rachitis shows itself as an intra-uterine malady. Both sexes are liable to it, and apparently, nearly in an equal degree. Cases have occurred in which it seemed to be hereditary, or in which it attacked several members of the same family.

It would appear from the accurate and masterly account of this disease by Glisson, published upwards of two centuries ago, that it first took its rise in the western parts of England about the year 1620, from which it gradually spread over the rest of Europe; where, however, especially in Great Britain, it is now comparatively rare. In this country it has always been extremely uncommon, even among the lower classes, whose children are its most frequent subjects.

*Causes.*—Much labor has been spent by writers in endeavoring to ascertain the exciting causes of rickets, but really to so little purpose that our knowledge regarding them can hardly be said, even at the present day, to be more accurate than it was in the time of Glisson and his immediate successors. From the circumstance of its appearing occasionally in several children of the same family, it has by many been considered as hereditary, nearly all the older, and not a few of the modern, authorities concurring in this view of its origin. It has also been supposed, and apparently with as little reason, to have an intimate connection with a syphilitic, strumous, or scorbutic state of the constitution. Others, again, have referred its origin to the influence of a vitiated atmosphere, such as results from living in damp, crowded, and ill-ventilated under-ground apartments; but it does not appear, so far as I am able to ascertain, that the children of such residents either in this or other countries are particularly prone to the complaint; certainly not so much so as to render it a special object of observation. Finally, there are many practitioners who look upon it as being due to the use of unwholesome or imperfect alimentation, causing an impoverished state of the blood, with lesion of innervation and nutrition; and this is, perhaps, as plausible a view as can at present be taken of the subject. With regard to its connection with scrofula, it may be observed that rickets rarely co-exists with tubercle, and also that the former disease does not generally occur so early in life as the latter. If syphilis has any agency in the production of rachitis, it requires to be proved, which it has not yet been, that the offspring of persons laboring under that malady are more prone to its attacks than other children. Whatever the exciting cause may be, there is no question that the immediate one is a deficiency of phosphate and carbonate of lime, upon which the solidity of the osseous tissue essentially depends. How far the want of chondrin and gelatin, which are such important elements of healthy bone, may disqualify the osseous tissue in rachitis for the reception of earthy matter is a problem which has not been determined.

*Morbid Anatomy.*—The alterations of the osseous tissue consequent upon this disease, may be conveniently arranged under three heads, each possessing marked peculiarities. In the first, the bones seem to be saturated with a reddish, watery fluid; a considerable quantity of which is also interposed between their outer surface and the periosteum, on the one hand, and between the medullary membrane and their internal walls, on the other. At a more advanced period, this fluid is replaced by a sort of gelatiniform substance, which, being particularly conspicuous in the situations here specified, becomes gradually organized and vascular, and ultimately adheres with great firmness to the parts with which it lies in contact. The periosteum is thickened



and injected, the nutrient vessels are remarkably enlarged, and the medullary membrane is sensibly altered in its character; the changes which it has undergone being similar to those of the fibrous envelop just mentioned, though less in degree. The lamellæ of the long bones, naturally so hard and compact, are a good deal softened, while the areolar structure is greatly rarefied, many of the cells being more than double the natural size. Similar alterations are observed in the short and flat bones.

In the second stage, a peculiar spongoid substance is formed between the periosteum and the outer surface of the bones, varying from two to three lines, or upwards, in thickness; and which, by the pressure it exerts upon the lamellæ of the compact tissue, sometimes forces them inwards upon the medullary canal, thus greatly reducing it in size, if not entirely obliterating it. Simultaneously with these changes the bones are rendered so soft that they may easily be bent, cut, and even indented with the finger.

In the third stage—that of resolution—the recently formed substance in the long bones, as well as in some of the flat and short, assumes a compact character, and becomes gradually identified with the pre-existing tissues, which at the same time regain their primitive solidity. Owing to the presence of this new matter, the bones are much larger than in the natural state, and their firmness, especially in the adult, resembles that of ivory. Hence the term *eburnation* is sometimes applied to this state of the skeleton.

When rachitis proves fatal, the body is usually found in a state of excessive emaciation; the muscles are thin, pale, and flabby; the adipose matter is almost entirely consumed; the cerebral substance is unnaturally soft; the liver and spleen are enlarged and flaccid; the intestines are attenuated and distended with gas, and there is not unfrequently marked tumefaction of the muciparous glands; the mesenteric ganglions are increased in volume and consistence; the heart is softened and smaller than common; the lungs, which are often congested, are more or less tuberculized in about one-sixth of the cases; and the bronchical ganglions are hypertrophied, loaded with serosity, and of a deep purplish hue. Occasionally there is partial ossification of the arteries, muscles, and other structures, as if they had become the recipients of the earthy matter which naturally appertains to the bones.

*Symptoms.*—The symptoms of rickets possess nothing of a definite character in the earlier stages of the disease, the approaches of which are generally stealthy, and at times almost imperceptible. The child is observed gradually to lose his health and spirits, becoming dull and listless, and laboring under derangement of the digestive organs, especially flatulence and colicky pains. After a while, marked emaciation sets in; the muscles are soft and flabby; the abdomen is tympanitic; the skin is dry and sallow; the face looks pale and doughy; the urine is scanty, turbid, and lateritious; and the alvine evacuations are thin, watery, and fetid, there being nearly always considerable diarrhœa. Dentition advances slowly, and the teeth, having a black, fuliginous aspect, often begin to decay almost as soon as they have pierced the gums. The fontanels and sutures are more open than in the natural

state; and the whole process of ossification is peculiarly slow and imperfect, or, rather, it may be said to be almost stationary, if not actually retrogressive. As the disease advances, the bones grow more and more soft, and, being unable to sustain the weight of the body or to resist the action of the muscles, are at length strangely and frightfully distorted. The head, although abnormally small, is disproportionably large to the size of the face, and is sunk down between the shoulders; the clavicles are bent and extremely salient; the spine is curved in various directions, especially laterally, and diminished in length; the pelvic bones are curved inwards, so as to lessen very materially the corresponding cavity; the ribs are flattened, and the chest, in consequence, is sensibly increased in its antero-posterior diameter, giving it a narrow, pigeon-shaped appearance. The bones of the extremities are shortened, bent, and twisted upon their axes, while their articular ends, or epiphyses, are softened, rarefied, and greatly expanded, thus appearing much larger and more prominent than naturally. If the child has begun to walk, he becomes daily more feeble on his legs; he waddles, trips, falls, and soon returns to his nurse's arms.

In rachitis, there is an actual arrest of development of the bones, and, although this want of growth pervades the entire skeleton, yet it is always most conspicuous in the lower extremities, the femur, tibia, and fibula being often fully one-third shorter than in the natural state, and also diminished in diameter, except at the epiphyses, which, as already seen, are always unusually large and prominent, especially if the child has been a good deal on his feet. Under such circumstances, the head and neck of the femur are sometimes forced by the weight of the body into a horizontal position below the level of the great trochanter; the individual is bow-legged, and the joints of the knee and ankle suffer great distortion from the weakened and relaxed condition of their ligaments. The flat bones, during the reparative process, become solidified and hypertrophied in their areolar texture, while the long ones are increased in thickness and strength along the concavity of their curvatures that they may be the better able to support the superincumbent pressure, and resist the effects of muscular action.

*Diagnosis.*—The only disease of the bones with which rachitis is at all liable to be confounded is osteomalacia, or softening. The signs of distinction, however, are commonly very evident. In the first place, rachitis is an affection of infancy and early childhood, whereas involution never occurs until after middle age. Secondly, in rickets the softened and flexible state of the skeleton is only temporary; after a time, a process of repair is set up, and, gradually continuing, the affected tissues become at length more firm and compact than they are in the natural state; in osteomalacia, on the contrary, the disease, once begun, generally progresses until the patient is worn out by his suffering, no attempt being usually made at restoration. Thirdly, in rachitis there is no material alteration in the urine, whereas in mollescence this fluid is always loaded with a large quantity of earthy salts, the kidneys taking on a vicarious action, and so carrying off the material destined for the supply of the bones. Lastly, in rickets there is

an actual arrest of development, in consequence of which the bones remain disproportionably short, thin, and dwarfish; in softening, on the contrary, the affected pieces retain their normal shape, although they are so changed in their consistence that they may readily be cut and bent in almost any direction.

*Prognosis.*—The prognosis of rachitis is generally unfavorable, for, although many patients escape with their lives, yet few recover without permanent deformity. In regard to the danger to life, it is commonly in proportion to the number of bones affected, the rapid progress of the complaint, and the age of the subject. Experience has determined that very young children are more liable to die of it than those who are more advanced in years, and those who are born of scrofulous parents than those who come into the world under more happy auspices. The duration of the disease is extremely variable; being very tardy at one time, and very rapid at another. In general, even under the most favorable circumstances, several years elapse before complete recovery occurs. The progress of the cure is often fatally arrested by some intercurrent malady, as measles, scarlatina, smallpox, or cholera. The longer recovery is postponed, the greater will be the danger of serious deformity. The duration of life is not necessarily shortened in persons who get well of rickets, cases having occurred of their having attained the age of sixty, seventy, or even seventy-five.

*Treatment.*—The treatment of rachitis is far from being satisfactory, or based upon sound philosophical principles. If, as has been asserted, every evil has its remedy, it is certain that human ingenuity has not yet succeeded in discovering any for this. The first point which it is of importance to inculcate is that, in rachitis, active measures are out of the question, our chief reliance being upon a properly regulated regimen and the use of tonics, with a view to the invigoration of the general system, and an improved condition of the blood, which, although it has never been thoroughly investigated in this disease, is beyond doubt materially altered in some of its component elements. Whatever, therefore, has a tendency to strengthen the patient, and enrich the circulating mass, must prove indirectly beneficial in removing the disease, and should claim serious consideration in every case.

The diet should be mild and nutritious, comprising an adequate amount of nourishment in the smallest possible space, so as not to oppress the stomach and create flatulence and acidity. The best article will, of course, be the mother's milk, or, when this is insufficient or unwholesome, fresh cow's milk, or, better still, the milk of the ass, which is now so much used in some of the larger cities of continental Europe, and which approaches nearer, in its composition, to human milk than that of any other animal. If the teeth are properly developed, a small amount of animal food will be useful, especially fat bacon, well boiled, and not too salt, with good stale bread, and a little mashed potato. The body should be washed at least twice a day with salt water, followed by dry friction, or rubbed with a moderately stiff salt towel; and, if the system be not too much reduced, cool or cold bathing will be found highly invigorating. Frequent exposure of the



little patient to the fresh air, and exercise suited to his age and strength, are to be rigorously enforced. The secretions are to be improved by alteratives, especially blue mass and mercury with chalk, while the bowels must be kept soluble with rhubarb or oil, and acidity be allayed by the alkalies, especially lime water and bicarbonate of soda.

Tonic medicines, particularly quinine and iron, given in small doses, and long continued, with an occasional intermission for a few days, are always imperatively indicated, and there are few cases which are not promptly benefited by their exhibition, especially in the early stages of the disease, although they are nearly equally useful throughout its entire progress. The mineral acids, and the tincture of the chloride of iron, have long been favorite medicines, both with the empiric and the regular practitioner, and are particularly advisable when there is a coexistent scorbutic condition. Alterative doses of mercury occasionally exercise a salutary influence, especially when the patient labors under the strumous diathesis, the best form being the bichloride, in combination with a small quantity of iodide of potassium, dissolved in water. The pain, which is often considerable, is controlled by opiates, either alone, or conjoined with diaphoretics.

Lately, the phosphates, which were formerly so much employed in the treatment of rachitis, on the ground that they would tend to supply the deficiency of earthy matter, have again come into vogue, but it remains to be seen whether they really possess any advantage over the more ordinary tonic remedies, already referred to, or whether they are not, indeed, inferior to them. Their best form of exhibition is the syrup.

Doubtless, however, the best remedy of all in this complaint, so far as any individual article is concerned, is cod-liver oil, given several times a day, in doses suited to the age and other circumstances of the patient. Possessing highly nutritive and alterative properties, it is admirably adapted to support the system, to enrich the blood, and to improve the secernent powers, which are so much at fault in rachitis. It may be administered either alone or in union with some of the more important tonics above mentioned.

Finally, the bed on which the rickety child sleeps should be perfectly smooth and somewhat elastic, so as not to permit the affected bones to sink down into any depressions or hollows, and so become bent and distorted. No pillow should be used, the head, body and limbs all resting on the same plane. The clothes should be loose and light, but sufficiently warm to afford the requisite protection to the surface. In the earlier stages of the complaint, mechanical contrivances may not only be regarded as altogether ineffectual, but as pernicious; by and by, however, as the bones become softened, they should be supported with appropriate apparatus, to prevent deformity. Walking must, of course, be avoided as long as the extremities are unable to bear the weight of the body.

## SECT. IX.—FRAGILITY.

Fragility of the osseous tissue is one of those affections which are to be regarded rather as an effect of disease than as a disease itself. It consists, as the name implies, in a peculiar brittleness of the bones, in which, especially in its more advanced stages, their substance is so completely changed in its character as to give way under the most trivial circumstances. All the bones are liable to this morbid brittleness, and cases occur, although rarely, where it literally pervades the whole skeleton. In 1857, the body of a female, supposed to be upwards of seventy years old, was brought into the dissecting-rooms of the Jefferson Medical College, with upwards of fifty fractures, received a few days before in a fall from a third story window upon the pavement below. Nearly all the ribs, several of the vertebræ, and a number of the long bones were broken, and signs of former fractures existed in the humerus, thigh, scapula, and other pieces. Devergie examined the body of a woman who died under symptoms of fragility, in whose skeleton there were not less than eighty-three fractures. Dr. Gibson met with a young man, whom I also saw many years ago, the bones of whose extremities were repeatedly broken by the most trivial accidents. The clavicles had suffered still more frequently, having been fractured altogether eight times. This universal fragility of the osseous tissue occasionally occurs at a very early period; sometimes, indeed, even in the foetus in the womb. Chaussier met with a remarkable example of this kind, where the long bones had experienced not less than one hundred and thirteen fractures, some being at the time perfectly consolidated, thus showing that they had taken place some time previously, while the rest were either recent or had partially united. The child survived its birth only twenty-four hours. General fragility, however, is a comparatively rare affection; usually it is limited to particular bones, or, still more commonly, to particular portions of a bone; and those which are most prone to suffer are the head and neck of the femur, the ribs, sternum, radius, ulna, clavicle, and superior extremity of the humerus.

When the affection exists in its highest state of development, the slightest accident is frequently sufficient to produce fracture, as a severe fit of coughing, kneeling upon a hard floor, or turning about in bed. Sometimes, indeed, the fragility is so great that the individual cannot be touched rudely, without the occurrence of the injury. Of this description was the memorable case of the woman, whose history has been recorded by Saviard, who could not be moved about in bed without breaking some of her bones. After a confinement of six months she died, when it was found that she had had fractures in all the long bones of the extremities, as well as of the clavicles, ribs, vertebræ, and pelvis, many of the pieces being so brittle that they could not be handled without crumbling into fragments, similar to old, dry bark.

*Causes.*—Fragility of the bones commonly comes on without any assignable cause, and the general health not unfrequently continues

good until a long time after it has made its appearance. In most cases, if not in all, it is merely symptomatic of some other disease, particularly of rheumatism, gout, syphilis, scrofula, and scurvy, attended with an altered and impoverished state of the blood, and impairment of the assimilative powers. The bones themselves are very much in the condition in which they are in osteomalacia, that is, their substance is more or less softened, in consequence of the removal of a large proportion of their phosphatic material, and they are often so completely saturated with fat as to render them unfit for preparations. On the other hand, however, they are sometimes remarkably dry and brittle. These facts would seem to show that their intimate structure undergoes some important anatomical change, the immediate result, it would appear, of inflammation, not of an active but tardy character. What tends to support this view of the nature of the affection is the circumstance that long before the bones manifest any disposition to break, the patient is harassed with severe pains, deep-seated, fixed, and referred to particular portions of the skeleton, and that, upon dissection, the diseased parts are generally found to be extremely vascular, their areolar structure being profoundly injected and infiltrated with bloody matter, apparently impoverished lymph, while the periosteum is very thick, spongy, and highly congested.

Fragility of the bones is one of the usual attendants upon old age. As we advance in life, their vascularity sensibly diminishes, many of the vessels shrinking down, and becoming finally entirely obliterated. It is owing to this circumstance that old persons, especially females after the fifty-fifth and sixtieth years, are so much more liable to fracture than to dislocation, the part most prone to yield being the neck of the femur within the capsular ligament, whose areolar tissue is often astonishingly rarefied, while the compact is hardly as thick as ordinary letter paper.

This affection is sometimes observed in several members of the same family. Dr. Pauli, of Landau, has related an instance where it was distinctly traceable through three generations on the father's side. All the grandchildren, five in number, had each had several fractures, one as many as five, in the bones of the extremities, and that mostly as the result of inconsiderable injury. They were all remarkably healthy, and there was no evidence in any of them of a scrofulous taint of the system.

*Symptoms.*—There are, unfortunately, no reliable signs in this affection. Hence it is usually overlooked until it has reached its highest point of development, when it is always incurable. In general, the person is laboring under severe pain, which is usually regarded as of a gouty, rheumatic, or syphilitic character, and which is rarely, under any circumstances, referred to its proper source, until after the occurrence of curvature, or fracture, from causes so slight as to awaken, for the first time, a suspicion of the existence of disease of the osseous tissue. As the disorder progresses, the appetite and strength become impaired, the pains increase in violence, and the urine is surcharged with earthy constituents, especially phosphate and carbonate of lime. This alteration in the urine is observable at an early period, and, in general



fragility, goes on gradually augmenting down to the time of death, which happens at from six to eighteen months, the patient meanwhile being perfectly bedridden.

There are, then, only two circumstances which can be at all relied upon as diagnostic of this complaint; one is the severe and intractable character of the pain, deep-seated, and usually referred to the bones; the other, the altered condition of the urine, as declared by the presence of an inordinate quantity of earthy matter, especially phosphatic. When these co-exist, the suspicion will be strong that there is serious lesion going on in the skeleton, and this suspicion will be converted into certainty when, superadded to them, there occurs, without any considerable external violence, curvature, fracture, or displacement of some of the bones.

Fragility, like softening, may generally be looked upon as an incurable affection. The only exception, perhaps, to this rule is when it occurs as an effect of the syphilitic, or rheumatic poison, and even then it seldom admits of complete relief unless it presents itself in a very circumscribed form. The fragility of old age is always incurable.

*Treatment.*—No rational treatment has yet been laid down for this disease, nor will it be possible to do so until we shall have more enlightened views of its etiology, pathology and diagnosis. Until, therefore, we are placed in possession of substantial information upon these points, our treatment must necessarily be altogether empirical. In all cases, strict inquiry should be instituted into the origin of the disorder, when such remedies should be administered as the result may seem to indicate. As a general rule, it may be stated that bleeding, except in very robust habits, is quite inadmissible, and even active purgation usually proves injurious. A tonic and supporting course, consisting of the different preparations of iron and quinine, and of the syrup of the phosphates, along with cod-liver oil, and vegetable acids, especially the citric, and a well regulated, nutritious diet will afford the best chance of relief. Iodide of potassium and bichloride of mercury may be given in the syphilitic variety of the disorder; while in the gouty and rheumatic forms, colchicum would probably prove beneficial. To relieve the excessive pain which is so prominent a symptom in the latter stages of the affection, especially when it involves a large portion of the skeleton, anodynes must be given in full doses once or twice in the twenty-four hours. Curvatures and fractures must be treated upon general principles. In most cases, the bones unite nearly as readily as under ordinary circumstances; sometimes, however, the process is very tedious, and at other times they refuse altogether to unite.

#### SEC. X.—ATROPHY.

Atrophy of the osseous tissue is characterized by the partial absorption of its elementary constituents, as is evinced by its lightness and porosity. It may occur in any portion of the skeleton, but the long bones are oftener affected than the short or flat. Like hypertrophy, it may be partial or general; that is, it may involve an entire piece, or

be limited to a particular part of it. Atrophy, moreover, may be concentric or eccentric. In the former variety the bone is diminished in its diameter; in the latter, it retains its original size, but is reduced in weight, and rarefied in its tissue. The causes under the influence of which it may take place are, protracted pressure, chronic inflammation, deficient nervous influence, and insufficient supply of arterial blood.

*a.* The influence of pressure steadily exerted for a considerable length of time, in producing atrophy of the osseous tissue, is well exemplified in the cranial bones in tumors of the dura matter; in the sternum and dorsal vertebræ in aneurism of the aorta; and in the ribs in cancer of the mammary gland. In all these instances the compact substance is reduced to a thin, translucent plate, while the spongy texture is either wholly destroyed, or worn down to a few slender threads. The immediate cause of the wasting process here is absorption, acting simultaneously and equally upon the animal and earthy constituents.

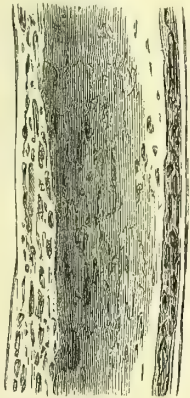
*b.* Atrophy from chronic inflammation is probably infrequent. One of the best specimens of it that I have ever seen occurred in a colored woman, who died of pulmonary phthisis at the age of forty. The body was much emaciated, and all the long bones were remarkably reduced in weight, though they had experienced no change in their external configuration. The compact substance was wasted to a mere shell, scarcely thicker than common wrapping paper, while the cells of the spongy texture were increased many times beyond the natural size. The medullary canal was much enlarged, and filled with a greasy, reddish substance, not unlike fresh adipocire. These appearances are well shown in the accompanying cut (fig. 22), and afford a beautiful illustration of the eccentric form of atrophy.

Atrophy is sometimes the result of local injury, as a blow, wound, or contusion. The wasting in this case may be limited to the site of the original mischief, or it may extend to the entire bone, which, however, is rare. In what manner such an injury operates, whether through the agency of inflammatory irritation, or otherwise, in giving rise to atrophy, is unknown.

*c.* Deficient nervous influence is a frequent cause of atrophy both of the osseous tissue and of the soft parts. In paralysis of the lower extremities, there is generally notable wasting, not only of the muscles, but also of the long bones, which are greatly reduced in weight, rarefied in their texture and diminished in size.

*d.* The effect of a diminished supply of blood in inducing atrophy of bone is sometimes very conspicuous in old fractures. In injuries of this description there is often considerable wasting of the osseous tissue, in consequence merely of the obliteration of the nutrient artery by the pressure of the callus. The atrophy is always eccentric, and is usually limited to one-third, one-half, or two-thirds of the affected

Fig. 22.



bone, according to the seat of the original injury, or, more properly speaking, the quantity of the new matter, and the extent of the vascular obliteration.

e. Finally, there is what is termed senile atrophy. In old age, the bones are rendered light, porous, and brittle; the compact substance is reduced to a mere parchment-like shell, while the areolar texture is remarkably rarefied or expanded; the muscular prominences are diminished in size; the animal matter is partially absorbed; and many of the vessels are obliterated. These changes are nowhere more conspicuous than in the neck of the femur, which, in consequence, often breaks from the most trifling causes, and which, after this occurrence, is seldom, if ever, repaired by osseous matter. Fig. 23 is a section of a well-marked specimen of this kind; the internal structure is very much rarefied; and the head of the bone, flattened and expanded, is approximated to the shaft, from the partial absorption of its neck. Fig. 24 exhibits the affection in a still more advanced stage.

Atrophy of the osseous tissue does not admit of cure. All that the

Fig. 23.



Atrophy of cellular structure of the thigh-bone.

Fig. 24.



surgeon can do is to amend the general health, when that is at fault, and to remove any local causes of disease when they are found to exist.

#### SECT. XI.—HYPERTROPHY.

Hypertrophy of the osseous tissue may be partial or general; that is, the abnormal growth may affect either a portion or the whole of a bone. The latter, however, is a very rare occurrence, though perhaps



not so much so as has been imagined. Cases, indeed, not unfrequently occur in which the broad bones of the head present an extraordinary degree of development, being more than an inch in thickness, and so hard that it is almost impossible to saw them. Under these circumstances, the two tables are extremely compact, the intermediate spongy structure being totally obliterated, or, rather, replaced by dense earthy matter. Similar appearances are sometimes witnessed in the cylindrical bones of the extremities. In an old femur in my private collection, the medullary canal is scarcely large enough to admit a common-sized quill; the whole shaft consists almost entirely of compact substance, in many places more than six lines in thickness. The bones of the male are always larger and more distinctly developed than those of the female; and the bones of persons who take much exercise, than those who are indolent, or make little exertion. By labor, their weight and dimensions increase; their spongy structure diminishes, whilst the compact becomes harder and more dense, and acquires an almost rock-like solidity; the muscular prominences are rendered more conspicuous; in short, everything indicates that they are in a state of general hypertrophy. When thus circumstanced, the osseous tissue usually contains a due proportion of animal matter; and hence it is always capable of resisting, in a very striking degree, the influence of such agents as have a tendency to injure it.

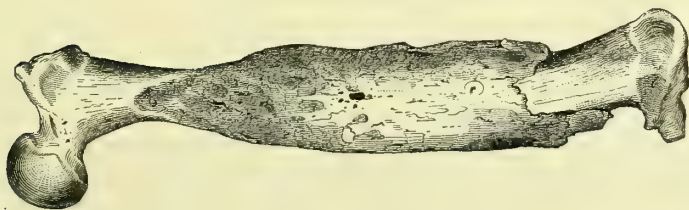
The adjoining cuts are excellent representations of general hypertrophy of the femur of a man affected with tertiary syphilis. Fig. 25

Fig. 25.



General hypertrophy—internal structure.

Fig. 26.



General hypertrophy—external characters.

is a section of the bone exhibiting its interior structure, which is very much condensed throughout, except at the superior extremity, where there are still some remains of the areolar tissue; the medullary canal is entirely obliterated, and the weight of the bone is nearly twice as

Fig. 27.



Hypertrophy involving both the thickness and length of the bone.

great as in health. Fig. 26 shows the external appearance of the bone. The drawings are from a specimen in my cabinet.

The adjoining sketch (fig. 27) is a specimen of hypertrophy of the bones of the leg and foot, both in thickness and length. It is from a drawing of a preparation in the collection of Professor Buchanan, of Nashville. All the bones are much enlarged, increased in weight, and anchylosed, at the ankle, tarsal, and metatarsal joints. The interosseous ligament was completely ossified. The foot and leg had been the seat of extensive ulceration, followed by exfoliation from the hypertrophied bones.

General hypertrophy of the bones is usually incurable. It is only, or chiefly, when it depends upon a syphilitic taint of the system that it admits of relief; but as this subject is fully discussed in the first volume, it is not necessary to revert to it here.

## SECT. XII.—TUMORS.

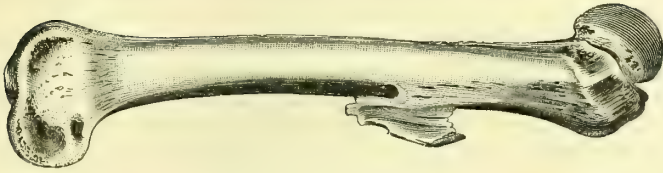
The bones, like the soft structures, are liable to two classes of tumors, the innocent and the malignant. The former includes exostosis, fibro-cartilaginous growths, aneurism, hematoid formations, serous cysts, hydatids, and myeloid tumors; the latter, encephaloid, colloid, scirrhus, and melanosis.

### INNOCENT FORMATIONS.

#### 1. EXOSTOSES, OR BONY TUMORS.

An exostosis is a bony outgrowth (fig. 28), the word, which is a Greek compound, signifying a bone growing from a bone. It is in fact a local hypertrophy, a circumscribed tumor, possessing essentially the same structure as the bone from which it springs, and with whose substance it is usually intimately identified. There is perhaps no term in surgical nomenclature which has been more abused than this, or which has been applied to so many different and almost diametrically opposite diseases. Among those who have especially contributed to bring about this confusion may be cited the name of Sir Astley Cooper, who, under the appellation of exostosis, has described almost every variety of tumor, whether benign or malignant, whether fleshy, fibrous, cartilaginous, or osseous, connected with or growing from

Fig. 28.



Exostosis of the thigh-bone.

a bone. This classification, which was for a long time blindly followed by most writers, has recently given way to a more correct appreciation of the subject, and I know no pathologist whose opinion is worth much who does not consider an exostosis as essentially a local hypertrophy, free from malignancy, formed in the same manner as the primitive osseous tissue, and composed essentially of the same anatomical elements; in short, as a bone growing from a bone, and not upon a bone.

Exostosis is observed chiefly in young and middle-aged subjects; I have never met with a case before the period of puberty, and it is rarely witnessed after the fiftieth year. It is more common in males than in females, and is generally confined to particular bones, as those of the cranium and of the extremities, particularly the femur, and the phalanx of the great toe.

The antrum of the superior maxilla is occasionally the seat of this disease. In a specimen in my collection, the inner surface of the left antrum is literally studded with these growths, none of which exceed a small grain of wheat, which they also much resemble in shape. The tumor sometimes acquires an enormous bulk, and cases occur in which both cavities are affected simultaneously, though not in the same degree.

In the flat bones, as those of the head and pelvis, the outgrowth may occur upon either surface; in general, however, it evinces a preference for the external one, probably because it has a more perfect periosteum. When the tumor is attached to the inner surface, its tendency is to encroach more or less seriously upon the contents of the cavity which the bone assists in forming. These internal exostoses, as they may be termed, are most common in the cranial bones of syphilitic subjects.

A tendency to exostoses is sometimes observed in several members of the same family. A few years ago, I had a lady under my charge on account of a tumor of this kind on the shaft of the left radius, whose sister and brother had each a similar enlargement, the former on the occipital bone, and the latter on the clavicle. Boyer gives the particulars of a case where the disease was hereditary, the patient's father, brothers, sisters, nephews, and children, having all suffered in a similar manner.

The number of these outgrowths varies from one to a considerable number. In general, they are solitary; but cases occur where there are a great many, as if there existed a sort of exostotic diathesis, as in fact there does under such circumstances. In Dr. Mütter's collection



is the skeleton of a female in which a large number of bones are thus affected.

Exostoses sometimes observe a symmetrical arrangement, tumors of the same size and shape occurring at the same points of the corresponding bones of the two sides. Such a disposition is occasionally witnessed on the frontal bone and lower jaw, but is most common on the humerus and femur, especially the inferior extremities of these pieces.

The *volume* of these growths is subject to no little diversity, some being very small, while others are extremely large, cases being occasionally noticed where they are of the size of an adult head. The most voluminous are usually found upon the bones of the extremities, particularly the lower part of the femur, though they are also sometimes seen upon the cranial, facial, and pelvic bones, where their presence is a source of the most hideous deformity.

Their *shape* is also very variable; sometimes they have a distinct, well-defined outline, being of a globular, ovoidal, or hemispherical figure; occasionally they jut out like long, slender spines or stalactites; in another series of cases, they have a knobby, nodulated, tubercular, or mammillated appearance; and, lastly, instances occur, although they are rare, in which they present themselves in the form of plates, or lamellæ. These varieties of shape are doubtless entirely due to accidental circumstances; but they, nevertheless, deserve attention, on account of their practical relations. In regard to their surface, this may be either perfectly smooth, scabrous, or spiculated; most generally the latter.

The adjoining sketch (fig. 29), represents a remarkable form of exostosis, from a drawing of a specimen kindly presented to me by

Fig. 29.



Dr. Lewis, of Alexandria. It grew upon the right femur of a lady, fifty-one years old, having commenced when she was only nine years of age. The tumor, before removal, was about the volume of a cocoa-nut, oval, smooth, and very hard. The integuments over its summit had latterly become inflamed and ulcerated, followed by a discharge of sanious matter, and the protrusion of a portion of bone. The general health becoming somewhat impaired, amputation was performed at the lower third of the thigh, the woman making an excellent recovery. The case of Dr. Lewis is additionally interesting from the circumstance that several of the relatives of the patient had been affected with similar tumors.

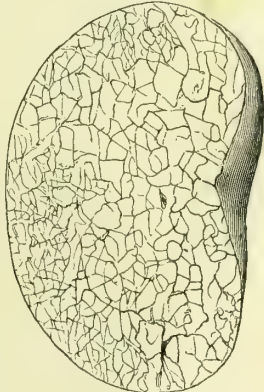
*Causes.*—The origin of exostoses is involved in doubt. There is no question that, in the great majority of instances, they arise without any assignable cause whatever. On

the other hand, they can often be traced directly to the effects of external violence, such as a blow, or kick. In the distal phalanx of the great toe, which is not an uncommon seat of the disease, it would seem probable that the pressure of a tight boot is able to produce it. Exostosis in the stump after amputation of the thigh and leg is probably caused by the jarring which the femur and tibia experience during the operation of sawing, aided, perhaps, by a partial laceration of the periosteum. A syphilitic taint of the system has generally been considered as an excitant of the complaint, and that it is capable of exerting such an influence hardly admits of doubt. Nevertheless, it is extremely probable that its agency has been greatly overrated; for I can recall but few cases that have come under my observation where it was possible to trace the relationship in a satisfactory manner. Rheumatism and gout are also often accused of causing exostoses, and although it is impossible, in the existing state of the science, to determine the character and degree of their agency in this respect, yet sufficient is known to justify the belief that it is very considerable. However this may be, it is extremely probable that these diseases play a most important part in the production of general exostoses, the history of most of the cases of the kind clearly proving such a connection.

Whatever may be the exciting cause of exostosis, there can be no doubt that the immediate cause is inflammation leading to a deposit, in the first instance, of plastic matter, and afterwards, of osseous, the process of development being precisely similar to that which presides over the formation of the original bone. The concomitant inflammation is not always seated exclusively in the bone, but partly in the bone and partly in the periosteum; and cases occur where there is reason to believe that the latter is mainly involved in the production of the tumor.

*Structure.*—In regard to its structure, an exostosis differs in no wise from healthy bone. It is essentially composed of two parts, a compact and an areolar, the former inclosing the latter like a dense, firm layer, varying in thickness from the sixth of a line to a quarter of an inch, according to the volume of the tumor. The compact substance sometimes constitutes the greater bulk of the morbid mass, and there are cases, especially when it involves the cranium, where it is of the consistence of ivory, being so close and hard as to render it extremely difficult to saw it. Such a structure is represented in the annexed sketch (fig. 30), from a specimen in my collection. The areolar texture is sometimes directly continuous with that of the bone from which the exostosis grows; at other times, however, it is independent of it, being either in immediate contact with the compact structure, or separated from it by a stratum of fibro-cartilage, cartilage,

Fig. 30.



An ivory-like exostosis, showing its internal structure.

or fibrous tissue. Its cells are of variable size and form, and are generally loaded with fatty matter, just as in a short bone of the skeleton, or in the articular extremity of the long.

The *identity* of the structure of exostosis with that of natural bone is proved, moreover, by chemical analysis. Even when the new substance is of unusual firmness, as in the eburnized variety of exostosis, the difference is much less than might, at first sight, be imagined. The following comparative analyses of healthy bone and of an ivory exostosis, by Berzelius, places the subject in a strong light. The principal difference, it will be observed, consists in the presence, in the latter, of an unusual quantity of phosphate of lime, and in a marked diminution of carbonate of lime and salts.

	Healthy Bone.	Eburnized Exostosis.
Animal matter . . . . .	33.30	28.57
Phosphate of lime and magnesia . . . . .	54.20	68.88
Carbonate of lime and salts . . . . .	12.50	2.00
Loss . . . . .	00.00	00.55
	<hr/> 100.00	<hr/> 100.00

When an exostosis is seated in a part of the body which is habitually the subject of considerable motion, as, for example, the inferior portion of the femur, it is usually surrounded by a distinct capsule, a sort of synovial burse, the object of which evidently is to ward off friction and facilitate gliding. The inner surface of the capsule, which is of a fibro-cellular nature, and of variable thickness, is perfectly smooth, unadherent, and lubricated by a sero-oleaginous fluid, so as to qualify it the better for the performance of its functions. Where no motion is required, the growth lies in immediate contact with the natural structures, the union between them being commonly so intimate as to demand a careful use of the knife to effect their separation. Occasionally, indeed, the soft parts are partially imprisoned in the osseous tumor, thereby rendering the dissection peculiarly tedious and difficult.

*Progress.*—The progress of this disease is generally tardy; it is only now and then that a case occurs which pursues a different course, or where the symptoms partake of an acute character. A syphilitic exostosis occasionally attains a considerable bulk in a short time, and the same thing has been observed, though less frequently, in the rheumatic form of the complaint. Under such circumstances, the formation of the tumor is generally attended with severe pain, liable to nocturnal exacerbations, tenderness and swelling of the part, and more or less constitutional disturbance. Ordinarily, however, there is nothing of the kind; the disease comes on slowly and almost imperceptibly, the first thing that arrests attention being a small tumor, which is altogether insensible, and exceedingly tardy in its progress, years elapsing before it acquires the size perhaps of a pullet's egg. If it be superficial, so as to admit of examination, it will be found to be hard and immovable from the first, and so it generally continues ever afterwards, whatever may be its bulk. Meanwhile, although it may itself be entirely indolent, yet it may be productive of pain in the surrounding structures, by the compression which it exerts upon the nerves, and in this way



the suffering is sometimes rendered exceedingly severe, being often of a neuralgic character, darting about in different directions, and extending far beyond the seat of the bony growth. When the tumor is situated in parts which are much exposed to motion, these parts are liable to become inflamed and tender, thus greatly aggravating the local distress. As the morbid mass enlarges it must necessarily act obstructingly, interfering with the functions of the affected structures, and ultimately, perhaps, entirely abolishing them. Thus an exostosis of the orbit may continue to increase until it pushes the eye completely out of its socket, not only filling the whole cavity, but encroaching more or less extensively upon the cheek and cranium. In a similar manner a bony tumor may project into the pelvis, and materially impede the delivery of the child. An exostosis of a rib may compress the lungs; of a vertebra, the spinal cord; of the cranium, the brain. Another effect which such a tumor produces is to stretch, flatten, and displace the muscles, tendons, nerves, and vessels, thereby partially disqualifying them for the exercise of their functions.

Sometimes the coverings of the tumor are invaded by ulceration and even gangrene, thereby more or less freely exposing its surface, which occasionally, in its turn, takes on the same kind of action. At other times the morbid mass perishes, apparently from the want of nourishment, and is detached very much in the same manner as a slough of the soft parts. Exostoses of immense volume occasionally experience such a fate. The occurrence will be most likely to happen when the tumor has a narrow, cartilaginous base.

*Diagnosis.*—The diagnosis of exostosis cannot always be easily determined unless the tumor is situated superficially, when its great firmness and immobility will generally serve to point out its true character without any difficulty. When the tumor occupies some internal cavity, its nature may be suspected, but no surgeon, however skilled in the art of discrimination, can positively say to what class of growths it really belongs. Besides, an exostosis may sometimes seriously interfere with the diagnosis of other affections. Thus, a tumor of this kind, occupying the pelvic cavity, may so impinge against the bladder, or even project into it, in such a manner as that the sound, coming in contact with its surface, shall impart a noise and sensation similar to those communicated by the presence of a calculus.

*Prognosis.*—The prognosis of this complaint varies. So long as the tumor remains small and indolent, it may commonly be considered as of little consequence; but when it increases rapidly, or is so situated as to interfere with the functions of a joint, or to encroach upon an important organ, it becomes a matter of serious import; the more so, because it is not always possible, under such circumstances, to get rid of it by an operation, and there is generally nothing else that can reach it. When an exostosis projects into a joint, an operation becomes a hazardous undertaking, liable to be followed by the worst results; and when it occupies an internal cavity it is generally utterly inaccessible. An exostosis of the inner surface of the cranium usually proves dangerous by determining epilepsy, paralysis, and other bad symptoms; in the

pelvis it may, as already stated, interfere with parturition, and in almost any part of the body it may induce neuralgia.

*Treatment.*—The treatment of exostosis must be guided, in great degree, at least in the earlier stages of the disease, before the tumor has acquired any considerable bulk, by the nature of the exciting cause, and hence special inquiry should always be made with reference to this particular point. When there is reason to believe that the affection has been occasioned by a deranged state of the system, induced by the action of the rheumatic, gouty, or syphilitic poison, colchicum, aconite, and iodide of potassium, either alone, or in conjunction with bichloride of mercury, will be indicated, and can hardly fail, if judiciously administered, to prove highly beneficial. Under the influence of these remedies the growth of the tumor is often promptly arrested, and ultimately even entirely dispersed. The use of mercury is particularly serviceable in these cases, but to produce its full effects it is generally necessary to carry it to the extent of gentle ptyalism, maintained for some time, especially in obstinate cases. When the complaint gives rise to much pain, opium, conjoined with diaphoretics, will be required.

Topical applications are particularly useful when the tumor is of rapid growth, exquisitely sensitive, and the result of external injury, or of a syphilitic taint of the system. In the earlier stages of the disease, the remedies most to be relied upon are leeches, blisters, saturnine lotions, and the tincture of iodine, employed in the ordinary way. If blisters be used, and my experience is that they are generally the most valuable of all topical means, the skin over the tumor should be raised very thoroughly, and a free discharge should afterwards be maintained by some stimulating unguent, the object being to excite a permanent pyogenic effect. In the syphilitic form of exostosis, mercurial fumigation sometimes answers a good purpose, succeeding when all other remedies fail.

When the tumor has attained considerable bulk, and, above all, when it is of long standing, and of great firmness, or productive of excessive suffering, the only chance of relief is ablation, or, if this be impracticable on account of the nature and extent of the exostosis, amputation of the affected limb. The incisions through the integuments are made as in cases of ordinary growths, the most eligible shape being the crucial, elliptical, or T-like. Free exposure is effected, and in doing this care is taken not to interfere with any important structures, the division of which might afterwards impair the usefulness of the parts. If the skin is diseased, or much attenuated, the affected portion is, of course, removed. The exostosis is then attacked with the knife and a common metacarpal saw, the former alone, if stout, being commonly sufficient to effect ablation when the tumor has a cartilaginous base, or an unusually soft structure. In general, however, the saw will be necessary, and there are many cases where the gouge, chisel, and trephine may be advantageously employed. If the tumor has a very large base, and is insensibly confounded with the substance of the bone from which it grows, it should be divided into several sections, by perforating it at different points, and then

detaching them separately, or piecemeal. Various kinds of saws have been invented for removing exostoses, but they are all more or less complicated and unwieldy, and may well be replaced by the more simple instruments in common use. In whatever manner the ablation be effected, there is one circumstance which should claim special attention, and that is to make the bony wound as smooth as possible by means of the raspatory, otherwise the rough surface will serve as a serious obstacle to cicatrization. As it is, there will, in any event, be more or less suppuration, retarding the progress of the case, and the patient may congratulate himself if he escape erysipelas and other serious consequences. The hemorrhage attending the operation is usually very slight. The edges of the wound should be lightly approximated, and the parts kept constantly wet with water-dressing, either cold, cool, or tepid, according to the exigencies of each particular case.

## 2. FIBRO-CARTILAGINOUS TUMORS.

The fibro-cartilaginous tumor (fig. 31), the *enchondroma* of recent writers, may be developed in the cancellated structure, or upon the outer surface of the bones, beneath the periosteum. Its figure is globular; its surface rough, or nodulated; its consistence firm, dense, and elastic; its color white, or grayish. When boiled, it yields a peculiar form of gelatine, termed *chondrin*. The tumor is essentially composed of a fibrous and of a cartilaginous substance. The former constitutes the nidus in which the latter is deposited, and consists of a vast number of oblong or rounded cells, from the size of a clover-seed to that of a pea. These cavities cannot generally be distinguished until the cartilaginous element has been scraped away, or removed by maceration. The morbid mass is strikingly conglomerate, and often attains a large bulk. When it originates, as it commonly does, in the central part of the bone, it gradually encroaches upon the compact tissue, which it expands into a thin, porous shell, either entirely osseous, or partly osseous and partly cartilaginous. Finally, the attenuated lamella gives way at one or more points, and thus allows the morbid growth to protrude beneath the periosteum, which is itself often very much altered in its character.

Fig. 31.



This tumor ordinarily affects only one bone, is not malignant, and is productive of little inconvenience, except from its size. It is peculiar to early life, is often directly chargeable to external violence, manifests no tendency to degeneration, not even when of long standing, is generally slow in its progress, and occasionally appears simultaneously in several parts of the skeleton. Every portion of the osseous system is liable to it; but the pieces most frequently affected are the metacarpal bones, the phalanges of the fingers, the humerus, and the lower jaw. To the tumor now described, especially when it is hard, fibrous, and



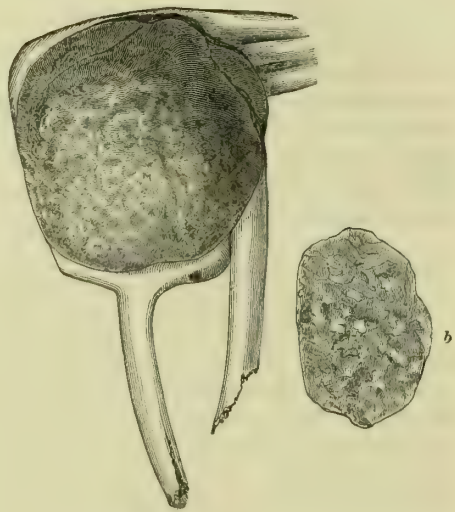
interspersed with the débris of osseous matter, or red and dense, like half-boiled beef, or fresh pork, the unmeaning title of osteo-sarcoma is usually applied by surgical writers. When the disease is of long standing, the growth sometimes undergoes partial ossification, as in the specimen represented in fig. 32. Fig. 33 exhibits a fibro-carti-

Fig. 32.



Enchondromatous tumor undergoing ossification.

Fig. 33.



Enchondromatous tumor of the ribs. *a.* External appearance. *b.* Internal structure.

laginous tumor of the ribs, from a drawing of a preparation in my collection.

The only remedy for this affection is free excision. All local and general means, even in its earlier stages, are unavailing.

### 3. ANEURISMAL TUMORS.

Aneurism of the osseous tissue consists in an extraordinary development of the minute vessels, and presents precisely the same anatomical features as aneurism by anastomosis of the soft parts. Confined usually to one bone, it may occur in several, or even in a considerable number. In one case it was discovered in the cranium, sternum, ribs, vertebræ, and innominate bone of the same subject. Its favorite seat is the upper extremity of the tibia, just below the knee. It may arise at various periods of life, but is most common in young adults. The tumor varies in volume from a pullet's egg to a cocoa-nut.

The disease always begins in the cancellated structure, which is converted into various sized chambers, filled with coagulated blood, disposed in concentric layers, as in old aneurismal tumors. Some of the cells occasionally contain fluid blood, or blood partly fluid and partly clotted; but this is rare. The outer table of the bone is expanded, attenuated, and perforated, or so soft, flexible, and elastic that

it may be bent like cartilage. In some instances, on the other hand, it is remarkably brittle, and may be crushed like the shell of an egg. The periosteum is thickened and indurated; but the joints in the immediate vicinity of the disease are commonly healthy, even when they are separated from it merely by a thin layer of cartilage. The vessels which ramify through the substance of the bone are tortuous, brittle, increased in size, and open by numerous little orifices into the aneurismal sac at various points of its extent.

The causes of this lesion are involved in obscurity. In some instances it has been traced to the effects of a blow; in others, to a fall, or jump from a considerable height. Either of these occurrences, by disturbing the vascular action of the bone, might produce the disease.

The enlargement, even in its early stage, is tense and painful; being attended with distension of the superficial veins, swelling of the surrounding structures, and slight discoloration of the skin. In a short time a deep-seated pulsation, or throbbing, synchronous with that of the left ventricle, and similar to what is witnessed in some erectile tumors, may be perceived in the affected part. In the advanced stage of the malady the beating is accompanied by a sort of undulating movement, and is easily interrupted by compressing the main artery of the limb between the tumor and the heart. The enlargement varies in size. In a case mentioned by Mr. Bell, it was more than nineteen inches in circumference, by upwards of six in length. In some instances, pressure applied to the tumor with the finger imparts a peculiar crackling sensation, not unlike that of dry parchment or an egg-shell. The soft parts around the disease are generally cedematous, the whole limb is apt to be swollen, and the motions of the contiguous joints are constrained and painful. Towards the last the general health always seriously suffers.

The only effectual remedy for this disease, provided its location be favorable, is amputation. In the early stage relief may possibly be afforded by securing the main artery of the limb. Lallemand relates a case in which ligature of the femoral artery completely arrested an aneurismal affection of the head of the tibia; but this must be regarded as an exception to the general rule.

#### 4. HEMATOID TUMORS.

There is a variety of tumor, closely allied to that just described, which, for the sake of uniformity in medical nomenclature, I shall term hematoid. It is produced by a deposition of blood in the cancellated structure, forming a firm, oval, and elastic tumor, filled with dark, solid coagula. The best specimen of this disease that I have met with, occurred to me, about ten years ago, in a man aged thirty-five, a portion of whose lower jaw I amputated, on account of what was supposed to be a bony tumor. The growth, which was about the size of a common orange, extended from the canine tooth on the right side to the middle grinder of the left, and consisted of a mere osseous shell, without any vestige of the cancellated structure; it was occupied by three red, solid coagula, the largest of which did not exceed the volume

of a pigeon's egg. The cavity was only partially filled by the clotted blood, which adhered to the inner surface of the bony wall, and was evidently organized. The tumor had appeared three years before without any assignable cause. Whence was this blood derived? Did it proceed from a rupture of some of the vessels of the bone? If so, the fact could not be ascertained by the most careful examination.

### 5. SERO-CYSTIC TUMORS.

Serous cysts, similar to those which occur in the soft parts, especially the ovary, kidney, and liver, are occasionally met with in various pieces of the skeleton, particularly in the lower jaw, the tibia, and femur. They are always developed in the areolar tissue, and show themselves in two distinct forms, the unilocular and multilocular, of which the first is by far the more frequent, the other being, in fact, extremely uncommon. Pathologists failed, until recently, to seize the distinctive features of this disease, and to assign to it a proper place in their nosological tables. Mention, it is true, was made of it by some of the authors of the last century, especially by Bordenave, but it was only in an incidental manner, and it remained for Dupuytren to furnish us with the first clear account of it. It is more than probable that what the older surgeons were in the habit of calling osteo-sarcoma and spina-ventosa were frequently, if not generally, growths of this description, with cavities filled with liquid or solid matter. I have certainly commonly found them so, and I must, therefore, conclude that the same thing has happened to others.

*Morbid Anatomy.*—The unilocular cyst varies in size from that of a hemp-seed to that of a pullet's egg, its shape being generally irregularly rounded, or somewhat globular. It consists essentially of a thin, delicate, polished membrane, having, apparently, all the characteristics of the serous tissue. This membrane is closely adherent to the bony wall of the cyst, and undergoes important changes in consequence of age, and repeated attacks of inflammation, becoming dense, thick, opaque, and tough. The contents of the cyst are variable: sometimes clear and limpid, like well water; sometimes cloudy, ropy, or glutinous; sometimes sero-purulent; and finally, again, though this is uncommon, thin and discolored, from the admixture of hematosin. Some of the older cavities occasionally contain solid matter, of an albuminous, curdy, or fibrous nature; and I have seen specimens in which they were occupied by a peculiar, micaceous-looking substance, not unlike cholesterine.

The multilocular cyst (fig. 34) is less frequent than the unilocular. As the name imports, it is composed of a greater or less number of cells, divided by bony septa, and lined by a serous membrane, similar to that which is present in the unilocular cyst, of which the multilocular appears to be merely an exaggerated variety. Its contents are generally of a sero-sanguinolent character, although sometimes they are clear and purely serous, like those of hydrocele. In one case, I found it thick and red, like the dregs of claret wine. In a group of multilocular cysts, a few will occasionally be seen to be filled with



solid matter, or matter partly solid and partly fluid. When this is the case, it may generally be assumed that the cysts are old, and that their vessels have undergone important changes in their secretory action, in consequence of which they pour out concrete instead of liquid substance. I have witnessed instances, however, in which the material was of such a nature as to induce the belief that it was originally effused in a solid form. However this may be, the substance is generally of a fibrous or fibro-cartilaginous character, and so firmly adherent to the walls of the cysts which contain it as to be with difficulty enucleated. Interspersed through this substance are occasionally little nodules, fragments or spicules of bone, and earthy concretions, or a combination of calcareous with osseous matter.

*Age and Sex.*—Serous cysts of the bones are most common in young adults and middle-aged subjects; being seldom met with before puberty, or after fifty. Both sexes are liable to them, but in what proportion, has not been determined. Their causes are involved in obscurity. In nearly all the cases in which I have had occasion to observe the disease, it came on spontaneously, without, apparently, any assignable reason whatever. In the lower jaw, which, as has already been stated, is its most frequent seat, its origin is often ascribed to the irritation of a decayed fang, or to violence done in the extraction of a tooth; but before we can admit the influence of either as a cause of serous cysts, it must be remembered that thousands of persons constantly suffer in this way, without any such occurrence, and hence the development of these bodies may, after all, under such circumstances, be a mere coincidence. So, also, with respect to blows, fractures, contusions, and other mechanical injury, so often invoked as sources of this and other organic maladies of the bones. If they are really capable of producing such an effect in one case, why should they not in another? We must, therefore, look beyond these causes, and conclude that some other agent is concerned in their origin, although of the nature of that agent we are entirely ignorant.

*Progress.*—The progress of this disease is always slow. In the jaw we often meet with cases of serous cysts of six, twelve, and even fifteen years' standing, without any serious disturbance of the general health, or any particular local disorder, save what results from the pressure of the tumor upon the surrounding structures. Neither the cysts, their fibrous contents, nor the parts adjacent manifest any tendency to malignancy, and I am inclined to believe that whenever such an occurrence is observed it is to be received as a strong evidence that the growth was originally of a bad character, and not that it became so in consequence of any new epigenesis. When the tumor is large,

Fig. 34.



Cystic disease of the femur.

whether it be multilocular or not, fluid or solid, it generally exhibits a marked tendency to destroy the bone in which it is located, pressing aside the compact lamella, and gradually involving its entire circumference. In the lower jaw the parts most commonly affected are the body and ramus, extending often beyond the middle line in front, and backwards as far as the condyloid process.

*Symptoms.*—The symptoms of cystic disease of the osseous tissue are obscure. The first thing that usually attracts attention is a dull aching pain, in some particular bone, as, for example, the jaw, which is often mistaken for toothache, or rheumatism; this gradually increases in severity and frequency, and is at length found to be dependent upon the presence of a hard tumor, or the expansion of a portion of the bone, more or less tender on pressure and motion, but unattended by any discoloration or intumescence of the overlying textures. The progress of the disease is always tardy, and it often happens that, after having attained considerable development, it remains, to all outward appearance, for some time perfectly stationary. Then, taking a new start, it again increases, and thus it continues, now advancing and now halting, until it has perhaps acquired the volume of a large orange, or even of a fist. Still, the general health continues good, there is no emaciation, and the countenance is perfectly free from that distressed, anxious, and sallow state which characterizes it in malignant disease. Even the pain is generally comparatively trivial, and if it were not for the mechanical obstruction occasioned by the encroachment of the tumor upon the adjacent parts, the patient would hardly be conscious of being unwell. If the parts be now carefully examined, they will be found to be of unequal consistence, the firmer parts being incompressible, while the softer ones readily yield under the finger, emitting a peculiar crackling noise not unlike that of dry parchment. In the absence of signs of malignancy, pulsation, lividity, and varicose enlargement of the overlying vessels, these circumstances afford the best evidence of the true nature of the disease, but if there be any doubt respecting it, this may generally be promptly dispelled by a resort to the exploring needle, the escape of serous, or sero-sanguinolent fluid determining the diagnosis. The tardy growth of the tumor and the absence of constitutional disorder are, indeed, commonly of themselves sufficient to mark the character of the malady. Between cystic and hydatid diseases of the bones no signs of distinction exist, nor is this a matter of importance, as the treatment is essentially similar.

*Treatment.*—The only available treatment in cystic disease is removal of the morbid mass, and some of the most brilliant exploits in modern surgery have been performed upon tumors of this kind. When it involves the jaw, the greater portion of that bone sometimes requires excision, the affected part being cut away along with a portion of the sound tissue, the same principle guiding the surgeon as in the extirpation of morbid growths of the soft structures. When the cysts are small and not numerous, they may sometimes be effectually scooped out, the cavity being afterwards stuffed with lint, and made to heal by the granulating process. On the other hand, cases occur, as when the disease involves the entire circumference of one of the bones of the

extremities, where neither of these procedures being available, nothing short of amputation will answer.

I am aware that various plans of treatment have been suggested for arresting this disease in its earlier stages, or curing it without the knife when it has attained a considerable magnitude. So far, however, as I am informed, there are none which are entitled to any confidence. The most plausible of these are iodine injections and the introduction of the seton; the former of which experience has proved to be ineffectual, while the latter is so unscientific as not to be thought of, much less practised, in any case.

## 6. HYDATIC TUMORS.

One of the most remarkable diseases of the bones is the development of hydatids in their spongy structure, an occurrence which, although uncommon, has now been so repeatedly observed as to entitle it to distinct notice in a systematic treatise on surgery. The first account of these bodies was given by two Dutch pathologists, Van Vy and Vander Haar. Since then attention has been directed to them by other observers, who, minutely detailing the facts which have come under their notice, have thus laid the foundation of our knowledge of this interesting subject.

Although it is extremely probable that all the different classes of bones are liable to these formations, yet they have hitherto been observed almost exclusively in the long and flat bones, particularly in the tibia, for which, judging from the frequency of their occurrence here, they appear to have a sort of preference. They have been found three times in the frontal bone, twice in the iliac bone, twice in the humerus, once in the femur, and once in a vertebra. What was formerly known under the vague name of spina ventosa was an osseous tumor which probably occasionally contained bodies of this kind.

*Situation.*—Hydatids of the bones are, as might be supposed, *a priori*, always developed in the spongy texture of the skeleton, as this alone affords them an opportunity of growing and expanding, the compact tissue being too dense and firm to admit of their increase. The only exception to this occurs when they form in the frontal sinus, but even here there is, it will be observed, no new law in operation, since the cavity in question is, in fact, only a large cell, exceedingly well adapted as a residence for such creatures. In the tibia, the disease is always situated in the spongy structure which exists in such abundance in the head of this bone, just below the knee.

How these bodies are developed is still a mystery. That the germs are conveyed to the spongy tissue of the bones in the blood which is sent to them for their nutrition and growth is evident enough, but why they should be deposited here in preference to other parts of the body is a question which the most refined pathology is unable to answer. Nor is anything certainly known in regard to the nature of the exciting causes of these bodies; for if, as has occasionally happened, they have shown themselves in a particular portion of the skeleton after the occurrence of a blow, contusion, or other injury, it



does not prove that their development was the consequence of such injury.

Sex does not appear to exercise any particular influence upon the development of hydatids of the bones, as they have been observed with nearly equal frequency in men and women. Most of the patients in which they have hitherto been found were adults, but in one instance they occurred in a child three years of age. Borchard has narrated a case where they existed in several situations in the same individual.

*Morbid Anatomy.*—Examination has proved that these bodies are really acephalocysts, similar to those which are occasionally met with in the liver, ovaries, lungs, and other internal viscera. Of a spherical or rounded shape, they are sometimes irregularly flattened, or compressed, and vary in size from that of a pea to that of a marble, their dimensions being evidently influenced by their age, and the extent of the cavity in which they are developed. Their number, which is seldom large, is usually in an inverse ratio to their volume. They are inclosed in a sort of parent-cyst, soft in structure, thin, and of a whitish appearance, and float about in the midst of a serous fluid, of a saline taste, and partially coagulable by heat, alcohol, and acids, circumstances clearly betraying its albuminous character.

The cavity in which these bodies are situated is deserving of special attention. It is evidently, in the first instance, simply one of the cells of the areolar tissue, in which the germ of the animal is deposited, and where it is destined afterwards to attain its full development. As its growth proceeds, it presses upon the osseous matter, pushing its fibres farther and farther apart, at the same time causing a partial removal of it by the action of the absorbents, until what remains is at length converted into a mere bony sheet, hardly as thick as a piece of parchment, elastic, and crackling under the finger. The shell is lined, as already stated, by a thin, closely adherent membrane, which evidently plays an important part in the development and protection of the new being. Cases occur in which it consists of several compartments, cells, or lodges, although in general it is unilocular. The bone immediately adjacent to the disease is usually thickened and roughened by irregular deposits.

*Symptoms.*—The symptoms attending the formation of these bodies are extremely obscure, and cannot, for a long time, be separated from those which accompany other diseases in and about the skeleton. Their growth is always very tardy, and a long time elapses before there is any pain and discoloration of the integuments. The patient is merely aware that there is some tumor, gradually augmenting in bulk, and slowly encroaching upon the surrounding parts; hard and firm, at first, afterwards more soft, and ultimately becoming quite elastic, and emitting a peculiar crackling sound on pressure very similar to that of dry parchment. If it be deep seated, it will cause a gradual wasting of the superimposed tissues, the muscles and tendons being spread out like thin ribbons, while portions of the fibrous membranes are actually absorbed. Meanwhile, the tumor mechanically impedes the functions of the surrounding parts, pain and tenderness set in, and the integuments show signs of irritation and discomfort. At this stage of the

complaint the affected bone sometimes gives way under the most trivial accident, refusing afterwards to unite, or undergoing consolidation only after a long while and after much trouble. Occasionally, the most prominent portion of the tumor ulcerates, and discharges a part of its contents; such an event, however, is extremely rare. The general health remains good for years, but in the end it is always much impaired in consequence of the local distress.

*Diagnosis.*—The most important diagnostic signs are, the tardy progress of the tumor, the want of pain and swelling, the change from a hard, incompressible substance to one of comparative softness and even elasticity, and the complete absence of all appearance, both local and constitutional, of malignancy. After all, however, these symptoms are merely of a negative character; for at last the only reliable source of information is the exploring needle, though this also, unfortunately, is not available until the morbid growth has acquired a great bulk, and is almost on the verge of bursting. Even the elastic feel and crackling noise which, in the latter stages of the complaint, form such prominent features, are of no diagnostic avail, as they are common to several other varieties of bony tumors.

*Prognosis.*—Hydatid disease of the osseous tissue is always a grave occurrence, not so much on account of the damage it does to the general health as on account of the injury it inflicts upon the affected bone, weakening its structure, and thus impairing its usefulness, generally to an irremediable extent. In several of the recorded cases the acephalocysts burst into the knee-joint, causing violent suppuration, and destruction of the functions of the articulation. In a few others, the animals perished, and shrunk up into dirty, reddish looking masses, which afterwards became a source of irritation, followed by high constitutional disturbance, excessive pain, and hectic fever.

*Treatment.*—The only remedy that can at all reach this disease is extirpation, and the earlier this is performed the better, for then there is no serious structural lesion of the bone, involving the necessity of resection or amputation. As soon, therefore, as the diagnosis is fully established, the tumor should be freely exposed by an incision, either crucial or elliptical, and attacked with the saw, pliers, trephine, or chisel and mallet, as may seem advisable. Its contents being turned out, the lining membrane of the osseous shell is carefully peeled off, or, when this is impracticable, painted with a strong solution of iodine, to destroy its secreting surface, lest there should be a speedy reproduction, if not of hydatids, at all events of serous fluid. The cavity is then filled with lint, smeared with cerate, and the flaps being approximated are lightly held in place with a few strips of adhesive plaster. The cavity will gradually shrink, and a cure be effected by the granulating process.

When the case is one of an aggravated nature, involving the entire circumference of the affected bone, or when the hydatids open into a joint, the only question will be whether the treatment shall be by resection or amputation. The former procedure can only be suitable when the disease is of limited extent; and in that event, it may probably always be replaced by excision, so that, in reality, it would be

difficult to imagine how or when it could be of service. Amputation will be necessary when the case is desperate, as when the bone is irremediably destroyed, or broken and unwilling to unite, or when the tumor has discharged its contents into a neighboring articulation, and has induced so much disturbance, local and constitutional, as to threaten life.

#### 7. MYELOID TUMORS.

The osseous tissue is more liable to the myeloid tumor than any other class of textures, and it is here that the new structure generally acquires its most perfect development. Doubtless it may occur in all, or nearly all, the pieces of the skeleton, but its favorite sites would seem to be the tibia, femur, and inferior maxilla, especially the latter. Commencing generally, if not always, in the cancellated structure, its point of departure is probably the endosteum, extending from thence to the compact layers, which it gradually disparts, and converts into thin, cartilaginous plates, bending and crackling under the finger like dry parchment. Continuing its growth, it may, in time, attain the size of a fist, or even of a foetal head, encroaching seriously upon the surrounding parts, and interfering, more or less, with the exercise of their functions. The arteries leading to it are generally somewhat enlarged, and the tumor itself is commonly quite vascular. A section of it exhibits a smooth, compact appearance, of a reddish, pink, or lilac tint, inlaid, as it were, with soft bony fibres, and pervaded by little cysts, either simple or compound, and occupied by different kinds of fluids, as serum, sanguinolent matter, or altered blood, or all these substances commingled.

There are no *signs* by which this growth can be distinguished from other tumors of the bones; its rapid development, its elastic feel, and its lobulated form assimilate it very much, in its external characters, to encephaloid, and the resemblance is still further shown by the fact that the disease is liable to recur after extirpation, and also that, in its advanced stages, the patient presents all the evidences of the cancerous cachexia. The only remedy is excision or amputation; excision, when the tumor involves the jaws, amputation, when it is seated in the bones of the extremities.

#### MALIGNANT FORMATIONS.

The various malignant affections of the bones may, as far as practical purposes are concerned, be all conveniently grouped under one head. Of these affections, encephaloid is much the most common; next in point of frequency is colloid, then comes scirrhus, and finally, as the most rare of all, melanosis. The origin, progress, and termination of these formations are the same here as in other organs and tissues.

1. *Encephaloid*, hernatoid fungus, cerebriiform cancer, or osteo-cephaloma, generally, if not invariably, originates in the spongy structure of the bones, from which it gradually extends to the compact lamella, and finally to the periosteum. It most commonly attacks the upper

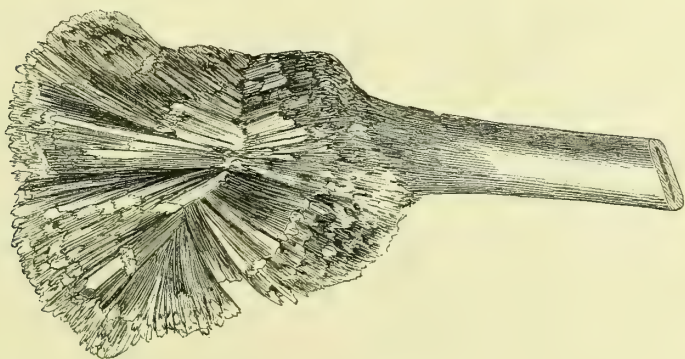


and lower jaw, and the long bones of the extremities, particularly the femur, humerus, and digital phalanges. No portion of the skeleton, however, is exempt from it. The most terrific feature of encephaloid is its tendency to recur in some other part of the body, after it has been dislodged from its original situation. It may show itself at any period of life, but young persons are most prone to it.

Although encephaloid may occur as an infiltration, it most commonly presents itself in the form of a tumor, arranged in rounded, lobulated masses, of the color and consistence of the medullary structure of the brain. Not unfrequently it contains small cavities, filled with clotted blood, dirty looking serum, or soft, gelatinous, oily, sebaceous, or melliceroid matter. Occasionally one part of the tumor exhibits the brain-like character, while another is strictly hematoid, or composed of a mixture of blood and encephaloid. In the great majority of cases, however, the two substances are pretty intimately blended together. Vessels, sometimes of considerable volume, may be seen ramifying over the surface of the morbid growth, and dipping into its interior. The outer table of the bone is transformed into a thin, parchment-like lamella, perforated in various places, or entirely destroyed by absorption. A section of the tumor usually exhibits, in addition to the appearances just described, osseous fragments, or pieces of fibro-cartilage. The superincumbent integuments, traversed by large bluish veins, are at first soft and glossy; but at length, from the constant and increasing pressure exerted upon them, they ulcerate, and allow the fungous mass to protrude.

Some of the more extraordinary alterations which the osseous structure is capable of undergoing in this disease are well seen in the annexed cut (fig. 35), from a specimen in the cabinet of Professor

Fig. 35.



Buchanan. The patient was a mulatto girl, about twelve years of age, who had labored for some time under a large lobulated tumor, partly elastic and partly inelastic, situated in the lower part of the leg, and attended with great dilatation and distension of the subcutaneous veins. Amputation being performed, the stump healed kindly, and for several weeks the girl did well; but in a few months she began to

complain of pain in her hip and side, and she died in less than a year, apparently from internal malignant disease. A section of the tumor displayed an immense number of osseous spicules, of extraordinary

Fig. 36.



Encephaloid disease of the thigh-bone.

length and delicacy, whose intervals were occupied partly by cartilaginous and partly by gelatinous substance, with here and there a cyst containing bloody-looking matter. The external characters of encephaloid are well displayed in the adjoining cut (fig. 36), from a specimen in my collection.

2. Of *colloid* of the osseous tissue very little is known. It is most frequently met with in the diseased conditions of the bones denominated osteo-

Fig. 37.



Colloid tumor.

sarcoma and spina-ventosa, which are often almost wholly composed of cells and cavities, filled with jelly-like matter. The question, however, respecting the identity of these affections can be determined only by future observation. A case in which a colloid tumor grew from the body of the sphenoid bone, outside the dura mater, came under my notice in 1844, in the medical ward at the Louisville Hospital. The patient died at the age of thirty-nine years from epilepsy, produced by a fall twelve months previously. On examination, Dr. Colescott and myself found, in the situation referred to, a lobulated tumor, of irregular form, and about the size of a pullet's egg, which had flattened the Varolian bridge, and evidently induced the disease in question (fig. 37). A section of the morbid mass showed that it was composed of several compartments communicating with each other, and occupied by a white, semi-concrete substance, in all respects similar to that of colloid.

3. *Scirrhus* of the osseous tissue is extremely uncommon. It occurs exclusively in old subjects, and is usually concomitant of the same disease in the breast or some other organ. Generally limited to a single bone, it may affect several pieces simultaneously, and always begins in the cancellated structure. Its favorite seat is the femur, but

it may appear in any part of the skeleton, in the short and flat bones, as well as in the long.

The heteroclite matter is deposited under two varieties of form, the infiltrated, and the tuberoid. In the former it is diffused through the areolar tissue, and exhibits the color and consistence of fibro-cartilage, or the rind of fresh pork. In the tuberoid variety the morbid mass is either solitary, or it consists of several agglomerated nodules, from the volume of a hazel-nut to that of an almond. Occasionally three or four distinct tumors are developed simultaneously in the same bone. They are of an irregularly rounded or oval shape, dense and firm in their consistence, and of a greenish, whitish, or yellowish color. The bone is seldom much altered in its size or external configuration, but is liable to be absorbed, and fractured at the seat of the disease.

4. The occurrence of *melanosis* in bone is very infrequent. It may appear in small, disseminated masses, nodules, or clusters, or in the form of an infiltration. It has been observed in various parts of the skeleton, but is most common in the pieces of the extremities, particularly the femur and tibia. Co-existing generally with melanosis in other organs, it is situated either upon the surface of the bone, beneath the periosteum, in the medullary canal, or in the spongy structure, the latter of which it sometimes dyes of a deep black color. In its progress and mode of termination it closely resembles medullary sarcoma.

*General Diagnosis, Progress, and Treatment.*—Much has been said, especially of late years, respecting the diagnosis of cancerous diseases of the osseous tissue, and from reading the accounts of these formations in the books one would suppose that their recognition was a matter of the greatest facility. Nothing, however, is more untrue. With the exception of encephaloid, it is extremely difficult to detect the real nature of any of them during any portion of their progress, and even encephaloid cannot always be satisfactorily discriminated until it has acquired an unusual bulk. In the latter case, the most reliable guides are, the early period of life at which the tumor shows itself, the rapidity of its growth, the great bulk it attains, the depth of its situation at the commencement of its development, the lobulated condition of its surface, and the extraordinary enlargement of the subcutaneous veins. In general, too, it will be found that the disease is developed in one of the long bones, as the humerus, femur, or tibia, and in preference, as it were, in their articular extremities. The moment ulceration occurs the case speaks for itself, the diagnosis being no longer equivocal.

The progress of encephaloid is generally very rapid, especially when it occurs upon the periphery of the bones, a few months usually sufficing for the formation of an immense tumor, and the complete destruction of the osseous tissue, or its conversion into a soft, sarcomatous, or fibro-cartilaginous mass, with hardly any trace of the primitive structure. The growth is commonly of a lobulated character, and of varying degrees of consistence, being soft at one part, tolerably firm at another, and perhaps almost bony at a third,



according to the nature of the portion examined. As it increases in size, it displaces the surrounding textures, flattening the muscles and nerves, and thus impairing their functions; the integuments are stretched, and, in places, attenuated; and the subcutaneous veins are enlarged, varicose, and of a bluish color. The colloid tumor is also capable of attaining a great bulk, but its progress is usually much more tardy than that of encephaloid, and there is seldom any considerable augmentation of the subcutaneous veins. Scirrhus of bone usually co-exists with scirrhus of the mammary gland, uterus, or liver, and the only symptom leading even to a suspicion of its existence is the peculiarity of the attendant pain, which is usually either sharp and lancinating, or else dull, heavy, or aching, and fixed in its position, the affected part being, at the same time, exquisitely tender on pressure and motion. The patient often becomes bedridden during the progress of the case, and the diseased bone not unfrequently gives way under the most trivial accident, as a mere twist of the limb in stepping out of the bed upon the floor. Melanosis of the osseous tissue is seldom discovered during life, unless it happen to be seated in a superficial bone, as the sternum, or one of the ribs; in nearly every instance that has yet been observed, it was present at the same time in other parts of the body.

Cancer of bone follows the same course as cancer of the soft parts. If left to itself, the malady inevitably proves fatal, and hardly any one makes a permanent recovery after an operation, however early and thoroughly executed. In all the cases of encephaloid of the extremities that I have either operated upon myself, or seen operated upon by others, there has been a speedy recurrence of disease, often indeed in less than three months, either at the cicatrice, the neighboring lymphatic ganglions, or in some internal organ, carrying off the patient a short time afterwards. I am aware that exceptional cases are sometimes reported, but they are only exceptional and nothing more, to say nothing of the fact that there may occasionally be in these cases an error in the diagnosis, the tumor, although possessing some of the outward properties of osteo-cephaloma, being in fact merely a benign one, appertaining to the osteo-sarcomatous class of the older writers. Judging from personal observation, I am inclined to believe that malignant growths of the maxillary bones are less liable to relapse after operation than those of any of the other pieces of the skeleton, and in this view of the subject, if I mistake not, the opinion of practitioners generally coincides. Nevertheless, even here the ultimate issue of the case is nearly always unfavorable. The circumstances justifying interference in this class of maladies, have already been so fully pointed out in the chapter on carcinomatous diseases generally, as to render any further discussion of them unnecessary in this place. In regard to the choice of the operation, as to whether this should be amputation or excision, the decision must always be given in favor of the former whenever the morbid growth occupies an extremity, the removal being effected as high up, or as near to the trunk, as possible, as conferring greater safety. Thus, when the hand is involved, the forearm should be cut off near the elbow, and in encephaloma of the

radius and ulna the limb should be amputated pretty close to the shoulder. If the tumor be seated in the upper jaw, the whole of that bone should be excised, together, perhaps, with portions of the palate, spongy, and malar bones. Thorough work must be made, or interference will be productive of infinite harm. After recovery from the operation, the patient must be put upon a properly regulated diet, with an alterative and tonic course of treatment, and exercise in the open air.

## SECT. XIII.—TUBERCULAR DISEASE.

Tubercles of the bones are much more common than is generally imagined. The bones usually affected are the vertebræ, the short bones of the hand and foot, and the articulating extremities of the long bones. The particular seat of tubercles is the spongy texture, though occasionally they are formed upon the outer surface of the bones, between it and the periosteum.

There are two varieties of form in which this matter is deposited. In one, perhaps the more common, the tubercles are *encysted*, the inclosing membrane, which varies in thickness from the fifth of a line to half a line, being composed of coagulating lymph, very soft at first, but gradually becoming harder and harder, until finally, in some cases, it acquires the character of fibro-cartilage. It is of a dull grayish color, is made up of delicate, inelastic fibres, crossing each other in every conceivable direction, and is frequently furnished with small vessels, passing into it from the surrounding structures. The number of tubercles is seldom very great; their size ranges from that of a pea to that of a nutmeg; and in most cases they present a yellowish, opaque appearance. When these bodies become softened, the matter will either work its way out, or pass, by a sort of fistulous route, into a neighboring joint, establishing thereby an analogy with pulmonary tubercles opening into the bronchial tubes. Sometimes a spontaneous cure takes place, the heterologous substance being absorbed, and the cyst contracting so as to obliterate its cavity.

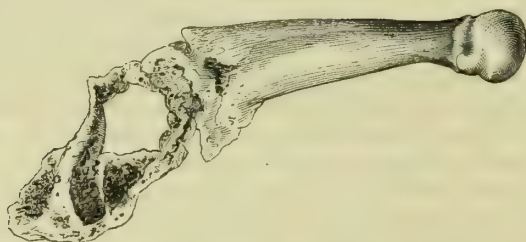
In the second variety, the tubercular matter is deposited directly in the cells of the osseous tissue, forming grayish, semi-transparent, opaline patches, from the one-sixth of an inch to an inch in diameter. This *infiltration* is noticed chiefly in the bodies of the vertebræ and in the bones of the tarsus, where it is frequently pervaded by numerous vessels, too delicate to be discerned with the naked eye. The bony tissue immediately around is sometimes deeply injected, but seldom otherwise diseased. In this, as in the preceding variety, the tubercular deposit, after having existed for some time, gradually softens, its vascularity disappears, and the cells in which it was contained are filled with earthy matter. This, however, is not always the case; for now and then the ulcerative process continues until the bone is totally destroyed.

The *progress* of tubercular disease of the bones is always chronic, though not equally so in both forms, the infiltrated proceeding more tardily than the encysted, and causing generally also a greater amount

of havoc in the osseous tissue. No definite information, however, can be furnished in regard either to the commencement of the softening process, or to the ultimate elimination of the matter produced by that action, from the affected structures. Much will doubtless depend, in every case, upon the condition of the system, the age of the patient, and the presence or absence of local complications. As a general rule, from six to twelve months will elapse from the moment of the deposition of the tubercular substance to the completion of the softening process. The matter resulting from the disintegration of the heteromorphous deposit is similar to that which occurs in the lungs, in the advanced stage of phthisis, being of a pale yellowish color, bordering slightly upon greenish, and of a thin fluid consistence, with small whitish flakes not unlike soft-boiled grains of rice. After an opening has been effected into the abscess, the discharge generally becomes very watery and bloody, as well as irritating, and comes away in large quantities, a number of sinuses often existing in the diseased parts, as if they were necessary to carry off the superabundant secretions. In many cases broken-down osseous tissue is intermingled with the pus, passing off either as little granules, or as minute fragments, which not unfrequently choke up the abnormal track, and thus excite new irritation.

The adjoining cut (fig. 38), from a specimen in my cabinet, exhibits the effects which a tubercular abscess may exert upon the

Fig. 38.



Tubercular excavation of the cuneiform bone.

osseous tissue, in causing a well-marked excavation, similar to what we see in the lungs.

The abscess that arises from the disintegration of the tubercular matter is the form which is usually met with in bone, the phlegmonous, as stated elsewhere, being of extremely rare occurrence. The symptoms attending it are generally obscure, but its existence may be suspected when, along with the ordinary signs of osteitis, the affected part is the seat of circumscribed, deep-seated, gnawing pain, with excessive tenderness at one particular spot, and a glossy, shining, cedematous condition of the integuments. The breaking of the abscess is always preceded by considerable swelling of the soft structures, and by more or less disturbance of the system, the constitution frequently sympathizing severely with the local trouble. In addition to these circumstances the history of the case, as the age of the patient, the site of the morbid action, and the absence or co-existence of strumous disease in other structures, will generally furnish



useful light, and thus materially aid in the establishment of a correct diagnosis.

The *treatment* of tuberculosis of bone differs in no material respect from that of tuberculosis in the other organs and tissues. Bearing in mind the fact that the local deposit is, in general, merely a reflection of the state of the system, the judicious practitioner will not neglect the employment of such remedies as are necessary to modify this condition of the constitution and to provide for the supply of a better and richer blood. The principal means included under this head are, a well-regulated and adequately nutritious diet, cod-liver oil, and the various chalybeate preparations, either alone, or in union with quinine, mild purgatives, and gentle exercise in the open air, especially if the seat of the disease do not act interferingly.

The local remedies are, of course, of the ordinary antiphlogistic character, consisting of leeches, blisters, and the dilute tincture of iodine, with early and free incisions of the soft structures to relieve pain and tension. If the existence of an abscess is suspected, prompt recourse is had to the trephine, the operation and after-treatment being conducted upon the same principles as in acute or phlegmonous abscess of bone, already described.

#### SECT. XIV.—NEURALGIA.

Neuralgia of the osseous tissue is infrequent. I have seen a large number—perhaps it would be more correct to say an immense number—of cases of neuralgia of the soft structure in almost every part of the body, but only a few of neuralgia of the bones. In nearly every instance that has fallen under my observation the disease was associated with some organic lesion of the affected texture, such as abscess, caries, exostosis, or interstitial deposits into the Haversian canals and cancellated tissue, thereby compressing the vessels and the nerves distributed through their tunics. A lady, aged fifty, a personal friend of mine, had long been afflicted with neuralgia of the cranium, caused by the falling of a window-sash upon the upper and posterior angle of the left parietal bone. The pain, without observing any regularity in its accession, gradually increased in severity, and became at length so intense as to require from one to two drachms of morphia a week, besides enormous quantities of sulphuric ether, for even its temporary subjugation. The seat of pain was a small spot, not larger than the end of the finger, and exquisitely tender to the touch. A disk of bone, embracing the affected portion, being removed with the trephine, an exostosis, not more than the eighth of an inch in thickness, was discovered upon its inner surface, which thus at once explained the nature of the case, complete recovery following the operation.

A married woman, aged twenty-eight, had suffered, at times, most acute and distressing pain from a small bony tumor at the anterior and outer part of the lower extremity of the left radius. The tumor had come on about twelve years previously, and had all along been exquisitely sensitive on pressure and even on the slightest touch. It projected

but little beyond the natural level, and was unaccompanied by any visible change in the soft parts. The pain had been liable to periodical exacerbations, and was often so severe as to deprive the woman of appetite and sleep. The general health was always good, the complexion denoting rather a robust state of the system, and the menstrual function being performed with great regularity. Upon removing the tumor, I found that its substance was almost of the consistence of ivory, offering great resistance to the instruments. The pain at once disappeared, and has never returned.

I have met with a number of cases similar to the last, which may be regarded as, in some degree, typical of this affection as it usually appears in the skeleton. Most of them occurred in young females, between the ages of twenty and thirty, without, seemingly, any direct connection with the catamenial function, which was usually well executed, and without any marked hysterical predisposition. In all the cases that I have met with, the pain was liable to periodical exacerbations, not, however, by any means always coincident with menstruation, and the parts were exquisitely sensitive under motion and pressure. The pieces which I have found most frequently affected were the radius, ulna, tibia, fibula, clavicle, and cranial bones, especially the frontal and occipital. In several instances I have known the coccyx to be the seat of neuralgia, the pain being so severe as to cause the greatest possible suffering. So far as my observation goes, the disease never attacks this bone except in married women who have borne children, and I presume that it depends here, as elsewhere, upon the presence of interstitial deposits, either as a simple hypertrophy, or a small exostosis, compressing the vessels and nerves of the osseous tissue.

Neuralgia of bone generally results from direct injury, as a blow, wound, or contusion, causing inflammation in the affected part, followed by a deposit of new osseous substance. It may also be produced by a syphilitic taint of the system, as we see in the tertiary form of this disease, in which the pains are not unfrequently of a darting, shooting, lancinating nature, or else dull, heavy, and aching, as in neuralgia of the soft structures. In abscess of bone the suffering is frequently of the same character, and hence the difficulty which the practitioner so often experiences in discriminating between the two affections. The disease is frequently associated with neuralgia in other parts of the body.

The *treatment* of neuralgia of bone is too often conducted upon empirical principles; a circumstance which is doubtless due to the fact that it is generally difficult, if not impossible, to ascertain the true nature of the disease. In recent cases, especially in such as are directly chargeable to the effects of external injury, a free incision down to the seat of the disease, dividing the periosteum and even the superficial layer of the bones, will occasionally effect a prompt cure, especially if the wound be kept open for some time with stimulating dressings to promote discharge. Now and then a small issue, made with the actual cautery, will answer an excellent purpose. When the cause is of a syphilitic nature, iodide of potassium and mercury afford the best means of relief. Quinine, arsenic, and strychnine are

indicated when the disease is of miasmatic origin. In obstinate cases, the only reliable plan is removal of the affected bone with the trephine or other suitable instruments; the object being to get rid of the compressing agent, whether this be merely simple hypertrophy of the part or an exostosis, properly so termed. Dr. Nott, of Mobile, has on two occasions excised the greater portion of the coccyx for the cure of this disease, but the results have not, I believe, been as satisfactory as had been anticipated.

## SECT. XV.—FRACTURES.

### 1. GENERAL CONSIDERATIONS.

There is no class of injuries which a practitioner approaches with more doubt and misgiving than fractures, or one which demands a greater amount of ready knowledge, self-reliance, and consummate skill. Constant in their occurrence, and often extremely difficult of diagnosis and management, they frequently involve consequences hardly less serious and disastrous to the surgeon than to the patient himself. If I were called upon to testify under oath what branch of surgery I regarded as the most trying and difficult to practise successfully and creditably, I should unhesitatingly assert that it was that which relates to the present subject, and I am quite sure that every enlightened practitioner would concur with me in the justice of this opinion. I certainly know none which requires a more thorough knowledge of topographical anatomy, a nicer sense of discrimination, a calmer judgment, a more enlarged experience, or a greater share of vigilance and attention; in a word, none which requires a higher combination of surgical tact and power. As for myself, I never treat a case of fracture, however simple, without a feeling of the deepest anxiety in regard to its ultimate issue; I cannot retire at night or rise in the morning without a sense of discomfort, so long as I am conscious that, despite my most assiduous attention and my best directed efforts, my patient is likely to become deformed and lamed for life. If this feeling were more general, it is easy to perceive that there would be comparatively few cripples from this cause, and comparatively few suits for malpractice, unfortunately so common, of late years, in this country, and so disreputable to the profession. A crooked limb, rendered so by injudicious treatment, is an unpleasant sight to a sensitive surgeon, reminding him constantly of his bad luck, his want of skill, or his inattention; not unfrequently it is a standing, living, speaking monument of his disgrace, planned by his own mind, and erected by his own hands. I would certainly not wish it to be understood by these remarks that it is always in the power of the surgeon to cure these accidents without deformity or impairment of function. To utter such a sentiment would be contrary to all experience and common sense. There are cases, and, indeed, they are not infrequent, where it is impossible to avoid such occurrences; cases where injury to bone, joint, and soft parts is so severe and complicated as to render any



other result totally impracticable, however attentively and scientifically they may be treated. The physician cannot cure all diseases : such is their character that many must, of necessity, prove fatal, and of such as do not terminate in this manner, there are many which, notwithstanding the most skilful management, sadly cripple the patient for life. The only difference between the surgeon and the physician, under such circumstances, is that the former is often blamed, if not severely censured, for the result of his treatment, perhaps long, arduously, and anxiously continued, while the latter often receives nothing but commendation and praise, when he may be no more entitled to it than the other. Every one thinks he can judge correctly of a surgeon's skill, but very few persons attempt to fathom that of a medical practitioner.

A fracture may be defined to be a solution of continuity of the osseous tissue, or, in other words, a yielding and separation of the bony fibres, occasioned either by external violence or muscular contraction. The lesion presents itself in various forms, of which the principal are the simple, compound, comminuted, impacted, and complicated. To these may be added the incomplete fracture, in which a bone, instead of being entirely broken across, is divided only in a portion of its diameter.

A fracture is said to be simple when it is unaccompanied by any wound of the soft parts directly over the end of its fragments, thus exposing them to view, or, at all events, permitting them to be felt. The case is a simple one, as far as the bone is concerned, even if there be a wound in the immediate vicinity of the fracture, provided it has no direct communication with it. A compound fracture is one where the opening in the skin and muscles extends down to the bone, the ends of which often protrude through the wound, girted, perhaps, by its edges. When a bone is broken into a number of pieces, the term comminuted is applied to it. The word impacted is employed to signify that the extremity of one fragment is forced into that of the other. Finally, a fracture is complicated when it is associated with dislocation, wound, hemorrhage, laceration, or other mischief. It will greatly facilitate the discussion of the subject if we discard all these terms, with the exception of the first and last. Hence, after some general observations, we shall treat first of simple fractures, and afterwards of fractures complicated with other lesions.

All the bones of the body are liable to be broken, though not by any means with equal frequency. Those which are most prone to suffer in this manner are the long bones of the extremities, particularly those of the leg and forearm. The clavicle is also frequently fractured. The scapula, the two jaw-bones, the sternum, ribs, innominatum, vertebræ, sacrum, and coccyx, together with the bones of the hand and foot, are rarely broken, owing either to their protected situation, to their mobility, or to the manner in which they are united to each other and to the surrounding parts. It may be stated also, as a general law, that the long bones are more liable to give way at or near their middle than at their extremities; a circumstance of some importance in a diagnostic and practical point of view.

Respecting their *direction*, fractures may be oblique, transverse, or longitudinal. Of these varieties, the first is by far the most common, though it is impossible, from the want of statistics, to estimate its relative frequency. My experience teaches me that transverse fractures are extremely rare. In the extensive osseous collection of Dr. Mütter, there is not a solitary specimen of the kind; and my own is equally barren. I am speaking now, of course, only of fractures of the long bones, and especially of fractures of their shafts; for in the short and flat bones such an occurrence is not without a certain degree of frequency. There is reason to believe that many of the so-called cases of transverse fractures of the shafts of the long bones are in reality oblique fractures, approaching more or less closely to the horizontal line, yet not strictly falling within it. There are few practitioners, I imagine, who will not coincide with me in this view, and who, like myself, have not had frequent occasion, upon further and more thorough exploration, to correct their diagnosis in cases of this description. If the question were one solely of a speculative nature, it would be of little consequence; but when we consider its practical bearing, it is impossible to lay too much stress upon it. As it will, however, be again adverted to when we come to speak of the treatment of fractures, nothing further need be said respecting it here.

Longitudinal fractures are extremely rare, so much so, indeed, that great doubt was at one time entertained respecting the possibility of their occurrence. That they do, however, occasionally take place, is sufficiently established by the cases that have been published from time to time in our medical journals, and by the specimens that are to be seen in different museums and private collections. They are nearly always produced by gunshot violence, and have hitherto been met with chiefly in the humerus, femur, and tibia. In a very few cases the fracture has passed nearly through the entire shaft of a bone; but, in general, it is not more than a few inches in extent. Occasionally a fissure of this kind, after having passed a certain distance, runs off in an angular direction towards the surface of the bone, where it terminates. A longitudinal fracture is sometimes seen at the inferior extremity of the humerus, and also, but more rarely, at the lower end of the femur, separating one of the condyles of these bones, or even both of these protuberances, as happens when there is at the same time a horizontal or oblique fracture a short distance above the corresponding joint. A longitudinal fracture is occasionally met with in the patella.

The extremities of the fragments of a broken bone exhibit much diversity in regard to their form and size; in general, one is much larger than the other, as well as more sharp, rough, and irregular. In the majority of cases, they have a ragged, serrated, or denticulated appearance, the projecting pieces of one end corresponding with the depressions in that of the other. This arrangement, which is produced by the irregular division of the osseous fibres, bears no little analogy to that which occurs in the edges of a lacerated wound. The truth is, to carry out the analogy still further, an oblique fracture is nothing but a lacerated wound of the osseous tissue, which presents the same difficulty in regard to its perfect coaptation and speedy reunion as

a similar lesion in the skin and muscles. The irregularities upon the extremities of the fragments are often sadly in our way, offering a great obstacle to the successful reduction and subsequent maintenance of the parts. Sometimes, indeed, the projecting pieces are so long and sharp as to pierce the integuments, or to require to be sawed off before the bone can be properly set. Such an occurrence is not uncommon in fractures of the tibia, and it is also witnessed, though less frequently, in the femur, the radius, and clavicle.

As a bone may give way at any part of its extent, at its middle, or at either end, it follows that the two fragments are rarely of the same length; instead of this, there is often a most marked disparity, as is exemplified in fractures of the extremities of the long bones, as the femur, in which, especially in fractures of its neck within the capsular ligament, the superior fragment is sometimes hardly an inch and a half in length, while the other is perhaps upwards of a foot and a quarter. Fracture of the olecranon affords a similar illustration. Such an occurrence is not without its influence in regard to the treatment and final issue of the lesion; for the nearer, as a general rule, the length of the fragments corresponds, the easier, all other things being equal, will it be to maintain their apposition, and secure prompt and perfect union.

A fracture may be single or multiple; that is, a bone may break at one or more places, sometimes as many as three, four, or even five; in other words, it may be literally crushed and comminuted. Such lesions are generally the result of inordinate violence, and are always liable to be followed by serious consequences; often, indeed, by loss of limb and life.

In fractures of the leg and forearm, affecting both bones, it is extremely rare to find the injury situated on the same level; so far, indeed, from this being the case, it generally happens that there is a considerable distance between the two fractures, amounting, according to my observation of numerous cases, ordinarily from one to two, three, and even four inches. The interval is usually considerably greater in the leg than in the forearm, probably because of the greater inequality in the size of its two bones. What the cause of this occurrence is it is not easy to determine; but it is reasonable to suppose, in the absence of positive information, that it is due mainly, if not entirely, to the manner in which these pieces are respectively articulated to the wrist and ankle-joints, in consequence of which the violence occasioning the lesion is transmitted more forcibly along one bone than along the other, thereby compelling the former to yield before the latter. Thus, as the tibia is more intimately connected with the foot than the fibula, it follows, if this explanation be correct, that it ought to break lower down than the fibula, and this, I believe, is what usually happens, although there are many exceptions.

Fractures occur at all periods of life, from the most tender infancy to the most perfect decrepitude. During delivery, the bones of the arm and leg are occasionally broken in rude attempts at extraction. In 1856, an infant, four weeks old, was brought to me on account of a fracture of the shaft of the right femur, caused two days previously



by a child rolling over it in bed. The thigh was much swollen, and at least an inch and a half shorter than the sound one; no extension and counter-extension that I could make with my hands enabled me to restore it to its normal length. Fractures occasionally occur in the foetus in the womb. Chaussier met with a remarkable example of this description, in which each of the long bones had suffered more or less from these lesions, some of which were recent, others beginning to unite, while others were consolidated. The child survived its birth only twenty-four hours. Cases of a somewhat similar character have been reported by other observers. In childhood, the bones being remarkably flexible, on account of the large amount of animal substance which they contain, are particularly prone to give way at their epiphyses; in old age, on the contrary, they are very dense and brittle, from the presence of an inordinate quantity of earthy matter, and are therefore extremely liable to break from the slightest causes. Thus, a fracture of the neck of the femur within the capsular ligament is often produced by a mere twist of the thigh in bed, by catching the big toe in a fold of the carpet, or by stepping off the curb-stone.

*Causes.*—The causes of fractures are generally divided into predisposing and exciting; the first having reference to the part and system, or to local and constitutional circumstances; the second to external violence and muscular action.

The conformation, situation, and office of certain bones are so many *predisposing causes* of fracture. Thus, as was before stated, the long bones, which are the great levers of locomotion, and which, in consequence, are constantly under the influence of large and numerous muscles, are much more subject to this accident than the short or flat bones, which are more passive in their character, as well as more closely articulated together, so that any force that may be communicated to them is more easily broken. The body of the scapula is seldom broken, because it is not only thickly covered by muscles, but having no fixed point below, it is incapable of being injured by any shock that is transmitted by the hand, elbow, or shoulder. The acromion process, however, owing to its exposed situation, is not unfrequently fractured; while the coracoid process, protected by the deltoid, clavicle, and head of the humerus, rarely suffers from this cause. The radius, being articulated with the hand, is more liable to break than the ulna; the fibula, owing to its slender form and brittle texture, is oftener broken than the thick and heavy tibia; and every surgeon knows how very prone the collar-bone is to fracture, its exposed situation, the peculiarity of its conformation, and its connection with the sternum and scapula rendering it particularly obnoxious to this occurrence.

Of the influence of *age*, in promoting the occurrence of fracture, mention was made in a previous paragraph, and it need not, therefore, detain us here. It may be stated, however, that, as we advance in life, there is superadded to the preternatural brittleness of the osseous tissue, another cause of fracture, namely, abnormal rigidity of the muscles, thus rendering us more liable to falls, and, consequently, more prone to the accident in question.

Various *diseases* or states of the general system have usually been

regarded as predisposing causes of fracture. Of these, the most common are syphilis, cancer, scurvy, and rickets.

That a *syphilitic* state of the system, involving the skeleton, may so affect some of the bones as to render them abnormally fragile is sufficiently established by modern observation. In 1847, I attended a man, aged thirty-one years, for a fracture of the body of the right humerus, caused, a short time previously, by throwing a small chip at a person. He was perfectly well at the time, with the exception of some nocturnal pain in the arm and forearm. He had had primary syphilis seven years previously, and had been treated with mercury. The bone united in five weeks.

It has long been an accredited opinion that *cancer* may so alter the constitution of the osseous tissue as to render it preternaturally brittle, and thus predispose it to fracture. Judging from the records of surgical science, such an occurrence cannot be regarded as so uncommon as is generally supposed. I have myself, however, seen only one instance of it. The patient was a female, seventy-three years old, from whom I had removed, with the assistance of my former colleague, Professor Miller, nine months previously, the left mammary gland, on account of scirrhus, under which she had labored nearly three years. The wound healed kindly, but, some time after, the disease reappeared at the cicatrice, and gradually carried her off, not, however, before she had become extremely emaciated and bedridden. During the last month of her life, she complained of almost constant pain in the right thigh, deep-seated, and particularly severe at night; and three days before she expired, in an attempt to turn in bed, the femur broke just above its middle. The limb was free from swelling and discoloration. No cancerous matter could be detected in the affected bone, which was quite soft, humid, and brittle, for some distance above and below the seat of fracture.

Of the influence which *scurvy* exerts upon the osseous tissue, in predisposing it to fracture, the modern practitioner has little opportunity of judging, as the disease at the present day seldom appears in that violent form which characterized it in former times. As described by the older writers, it was often attended with the most horrible ravages, in which the skeleton not unfrequently participated, the synovial membranes, cartilages, and ligaments being ulcerated, and the epiphyses separated from the bones. In 1855-6, the scurvy prevailed extensively in certain regions of the United States, especially in the Southwest, but I am not aware that it predisposed any of its subjects to the occurrence of fracture, or that it retarded the process of reunion in those who suffered from it at the time.

There are certain states of the skeleton, including *rickets*, in which the bones become so remarkably brittle as to break under the most trivial injury. Cases are recorded where, from these and other causes, nearly every one of the long bones was broken not only once, but a number of times. What is remarkable in these cases is that they usually recover quite as soon as ordinary fractures. I have in my collection a part of the skeleton of an old woman, who, in falling from a second-story window down upon the pavement below, received not

less than fifty-three fractures, involving the vertebræ, the scapula, the bones of the pelvis, and most of the bones of the extremities.

*Gout* and *rheumatism* are sometimes enumerated as predisposing causes of fracture. The following case, which I had an opportunity of seeing with Dr. Metcalf during my residence in Kentucky, would seem to countenance the possibility of such an occurrence.

Henry Welker, a common laborer, aged thirty-two, had always enjoyed good health until two years and a half ago, when he was attacked with articular rheumatism, affecting the principal joints, first of the superior, and then of the inferior extremities, where it has continued for the last twelve months. The only cause which he can assign for his suffering is exposure to cold and fatigue in a pork-house, where he had worked for fourteen successive winters. In December, 1855, he broke his thigh-bone, at the junction of the lower with the middle third, while pulling off his boot with his hands, the foot being at the time bent at a right angle with the leg. No pain or swelling followed the accident. The most remarkable feature in the case, when Dr. Metcalf first saw it, was the imperfect aeration of the blood, as indicated by the livid state of the face; the bowels were torpid, the tongue was coated, and there was considerable emaciation, but no disease of the heart and lungs. No chalky deposit existed in the joints. At the end of a month and a half, the parts being united, the dressings were removed, and the man was permitted to walk about on crutches. A week after this, he struck the affected thigh slightly against the rail of the bed, fracturing the bone at its upper third. Union took place in about the same time as before, the quantity of callus in each case being uncommonly large.

The *efficient causes* of fracture are two, external violence and muscular contraction. The former, which is by far the more common, may act upon a bone either directly, or indirectly through some other bone. In the first case, the force is applied to the bone itself, as in fracture of the jaw from the kick of a horse, or in fracture of the leg from the passage of the wheel of a carriage. Most fractures are of this description, and hence they are generally complicated with more or less injury of the soft structures. In the other case, the force, instead of being applied immediately to the bone, is transmitted to it through another bone, or perhaps a chain of bones. It is in this way that the radius is so frequently broken just above the wrist by falls upon the hand, the force being concentrated upon its inferior extremity, in consequence of the manner in which it is articulated with the carpus, while the ulna, which is but slightly connected with it, generally escapes. Fracture of the clavicle affords an instance of a bone being broken by indirect mechanical violence operating at two opposite points. Thus, in falls upon the shoulder, the sternal end being impelled by the weight of the body, and the acromial end by the object which it strikes against, the bone, acted upon by the two forces, gives way at its weakest part, which is usually about its middle. When a bone is very brittle, the slightest external violence may be sufficient to break it. In old people the neck of the femur is frequently fractured



by the merest twist of the limb in bed, or by stepping carelessly out of the bed upon the floor.

It is not often that a bone is broken by muscular action, and yet such an accident is not, perhaps, as uncommon as is generally imagined. I have myself met with but three instances of it. In two, the subjects were remarkable for their health and muscular developments, and the fracture in each was produced while they were engaged in feats of strength, in which the elbows were planted firmly upon a counter, and the hands interlocked with each other. While the muscles of the arm and forearm were in a state of the utmost tension, the humerus snapped off suddenly, with a loud noise; in one case at its middle, and in the other at its inferior extremity. In the third case, the fracture, also seated in the humerus, was caused by throwing a small chip. In this instance, alluded to in a previous paragraph, the bone had suffered for a considerable time under nocturnal pains, and had evidently been rendered brittle by the effects of the syphilitic virus. The patient, aged thirty-one, was otherwise in good health, but the muscles of his arm were rather soft and flabby. The patella and olecranon are frequently fractured by the action of the extensor muscles of the thigh and arm. From the above cases, it is evident that a diseased state of the bone is not at all necessary to the production of this accident by muscular contraction, although such a change is perhaps generally present at the time of the fracture, and therefore deserves to be considered as a predisposing cause of it.

## 2. SIMPLE FRACTURES.

The symptoms of fracture may be considered, first, in relation to the broken bone itself; secondly, in relation to the soft parts; and thirdly, in relation to the constitution.

So far as the affected bone is concerned, there are only three symptoms which are at all reliable as evidences of the existence of fracture. These are crepitation, deformity, and preternatural mobility.

*Crepitation* is the peculiar noise which is produced by rubbing the two ends of the broken bone against each other, and is always, when well marked, characteristic of the nature of the injury. In general, it can be both heard and felt. In order to produce it, it is necessary that the ends of the fragments should be at least partially in contact, and hence, to effect this object, the surgeon is often obliged, as a preliminary step, to extend and counter-extend the affected limb. For this reason it is always absent in impacted fractures, while in fractures of the leg and forearm, involving only one of the bones, it is usually very faint and indistinct from the difficulty of moving the broken pieces upon each other. Much swelling, or great depth of muscle will also obscure the crepitation.

*Deformity*, although not invariably present, is, in general, one of the most prominent symptoms of fracture. It exhibits itself in different forms, as in shortening, or in angular displacement, and usually occurs at the time of the accident, the cause which produces the fracture being itself the cause of the distortion. Occasionally, however, it does not come

on until several hours, or perhaps even days after ; as, for example, in a partially impacted fracture of the neck of the thigh-bone, in which the patient may be able to walk some distance, and yet the limb retain its normal shape. The degree and character of the deformity are greatly influenced by the nature and situation of the fracture. Thus, the more oblique a fracture is, the greater, as a general rule, will be the displacement of the ends of the fragments, and, consequently, also the distortion of the limb. Sometimes, as in fracture of the patella, the olecranon and calcaneum, the deformity manifests itself by a vacancy or hollow at the natural situation of the bone, and by an unusual protuberance upon the lower part of the thigh, arm, and leg, caused by the separation of the upper fragment by the action of the extensor muscles. Finally, the deformity may be much increased by the extravasation of blood consequent upon the injury, or by the effusion of serum and lymph consequent upon the resulting inflammation.

Preternatural *mobility* is, next to crepitation, the most important and reliable symptom of fracture. There are few instances in which it is wholly absent, while in the great majority it exists in a well-marked, if not in a high, degree. It usually appears immediately after the occurrence of the accident, and continues to a greater or less extent until the completion of the consolidation of the fracture. In the impacted fracture it may be entirely wanting, or remain absent until the ends of the fragments are unlocked. In fracture of the leg and forearm, involving only one bone, the degree of mobility is sometimes very slight, the sound bone impeding or altogether preventing the motion of the affected one.

In every fracture produced by external violence, whether applied directly or indirectly to the part, there must, of necessity, be a certain degree of *contusion* of the soft structures at the seat of the injury. It may be limited to the skin and subjacent cellular tissue, or it may extend deeper, and involve the muscles, aponeuroses, vessels, nerves, periosteum, and even the bone itself. In consequence of this occurrence, there is not unfrequently a considerable effusion of blood beneath the skin, and in the connective tissue of the muscles, causing distension and sometimes discoloration. For the same reason, there is generally a good deal of pain, often of a sharp, spasmodic character, which is aggravated by the slightest motion of the parts, and by every attempt at exploration. It has its seat rather in the soft structures than in the affected bone, although the latter generally participates in it, and by the sharpness of its extremities frequently increases its severity. A short time after the accident, swelling usually sets in, and often proceeds to a considerable height, its degree being greatly influenced by the amount of injury sustained by the soft parts, by the motion to which the fractured bone is subjected, and by the state of the system at the time of the accident. As a general rule, it may be affirmed that the pain and swelling are less in fractures produced by muscular contraction than in such as are caused by mechanical violence, whether directly or indirectly applied.

Inability of motion in the affected bone, and in the portion of the

limb articulated with it, is generally a prominent symptom. Cases, however, occur in which it is either very slight or where it is entirely absent. In an impacted fracture of the thigh, for instance, a patient has sometimes been known to be able to walk for a considerable distance without the slightest assistance even from a cane, and in fracture of the clavicle, I have repeatedly seen him carry his hand to his head, and even perform the function of circumduction of the arm.

Another symptom, consequent upon fracture, is *spasm* of the muscles at the seat of the injury; it is most common in nervous, irritable persons, and generally comes on within a short time after the accident. When severe, as it frequently is, it constitutes a source of real suffering. It is aggravated by motion and inflammation, and may continue, with more or less interruption, from several hours to several days.

Finally, the patient often experiences a sense of *numbness* in the affected part, reaching frequently to the distal extremity of the limb. This may be caused either by the injury sustained by a nervous trunk at the time of the accident, or by the compression of the soft parts by extravasated blood, or the ends of the broken bone. Sometimes it does not arise until inflammation has supervened, and then it is generally owing to the presence of an unusual quantity of serum and lymph.

The amount of *constitutional* disturbance in fracture varies, in different cases, from the slightest exaltation of the normal action to the most intense excitement, depending mainly upon the nature of the fracture, the degree of violence sustained by the soft parts, and the state of the system at the time of the accident. In very many cases, there is an entire absence of traumatic fever, while in others it is present in a very high degree, the pulse being strong and frequent, the countenance flushed, the skin hot and dry, the thirst intense, and the appetite and sleep much impaired, if not totally suspended. In the more severe forms of fracture, the patient often experiences a severe shock, from which he may not fully recover for many days, or which may even terminate in death. Whenever there is much constitutional disturbance, the affected limb will be apt to be in a high state of inflammation, the parts being hot, swollen, and painful, and, at times, even covered with small vesicles, such as a heedless observer might easily mistake for the phlyctenulæ which so often announce the occurrence of gangrene.

*Displacement of the Ends of the Fragments.*—The displacement of the fragments shows itself, as already stated, in two principal directions, the longitudinal and horizontal. Of these, the former is by far the more common, as it is present, to a greater or less extent, in nearly all cases of oblique fracture, in whatever portion of a bone occurring. It is produced by the overlapping of the extremities of the broken bone, the lower being drawn above the upper, or the one riding over the other, as it is sometimes expressed. The extent of this form of displacement varies from the slightest possible change in the length of the affected bone to two, three, and even four inches, which may be regarded as its maximum. It is generally most conspicuous in fracture of the femur and humerus, while in fracture of the forearm and leg, affecting only one bone, it is either very slight or totally wanting.



Finally, the displacement may be lateral, anterior, or posterior, according to the nature of the exciting cause.

In the horizontal displacement, the lower fragment may form an angle, more or less acute, with the superior, thereby giving the bone an arched appearance; or, the two pieces remaining in contact with each other, the inferior one may perform a rotatory movement, while the other continues perfectly stationary. In some cases, as in fracture of the lower end of the radius, there is often considerable lateral displacement, and similar phenomena are apt to occur in fracture of the tibia and fibula at or near the ankle-joint.

The causes of displacement are, muscular action, mechanical violence, and the weight of the limb connected with the broken bone. Of these the first is the most common, and it need hardly be added that a knowledge of the fact is of the greatest practical importance in regard to the proper management of the injury. In some instances the displacement is entirely produced by the vulnerating body. Thus, in fracture of the nose the blow which inflicts the injury also displaces the fragments. The wheel of a carriage passing over the leg may not only break its two bones, but likewise cause great deformity by forcing asunder their extremities. Finally, the displacement may be occasioned by the weight of the limb connected with the injured bone, as in fracture of the clavicle, in which the outer fragment is drawn downwards and inwards by the weight of the shoulder and arm.

*Diagnosis.*—The most valuable symptoms of fracture, diagnostically considered, are, as was previously stated, crepitation, deformity, and preternatural mobility. The co-existence of these symptoms is unmistakably denotive of the nature of the accident; but, unfortunately, they are not always associated; one or even two may be absent, and hence a case that ought to be treated in the most prompt and decisive manner, may, for the want of a correct appreciation of its character, be either entirely neglected, or, at all events, grossly mismanaged. Besides, the symptoms here enumerated may be simulated by other accidents, especially dislocation, and certain affections of the joints.

The crepitation of fracture is sometimes imitated by the grating produced by an effusion of plastic matter into a joint, the sheath of a tendon, or a synovial burse; and the difficulty may be still further increased, if, under such circumstances, the suspected fracture is situated near a large articulation. In general, however, it will be sufficiently easy to distinguish between them by a consideration of their respective characters. In fracture, the crepitation can be both felt and heard; it is dry, coarse, or rough, resembling the sensation and noise produced by rubbing two unequal surfaces against each other. The crepitation from plastic matter, on the contrary, is of a finer quality, or more faintly marked, and may be likened to the feel and noise caused by gently rubbing over each other two pieces of sole leather; in a word, it lacks the roughness and distinctness of the other. Moreover, it must be remembered that it is never present until after the occurrence of inflammation, whereas the other always exists from the very beginning of the accident. Crepitation, it is true, might be produced in consequence of previous disease, and the possibility of such an occurrence should

not be lost sight of in our examinations. Finally, where the case is obscure, the crepitation may sometimes be detected by the aid of the stethoscope, especially when the bone is thickly covered by muscles, as in fracture of the neck of the femur within the capsular ligament, or in fracture of the ribs in corpulent subjects. This mode of examination was originally suggested by Lisfranc, but, as the expectations held out by him have not been realized, few practitioners of the present day resort to it.

The deformity in fracture manifests itself either in shortening, in lateral displacement, or, as not unfrequently happens, in the two united. Elongation is never present, in which respect fracture differs from certain forms of dislocation, in which lengthening is a prominent symptom. The degree of shortening varies from a few lines to several inches, and is, therefore, an occurrence of much value in a diagnostic point of view. It may exist from the commencement of the accident, or it may not show itself until some time after its occurrence, being materially influenced by the action of the muscles, and the nature of the treatment. Whatever the degree of the deformity may be from these causes, it may always be effectually removed by extension and counter-extension, either alone or aided by pressure; but as soon as these forces cease to operate, it is usually immediately reproduced, which is not the case in dislocation. Here, the reduction having been effected, the parts generally retain their relations until some new cause produces a new displacement.

Too much stress cannot be placed upon preternatural mobility as a sign of fracture. Next to crepitation, it is unquestionably the most important diagnostic symptom we possess. There may be unnatural latitude of motion in a dislocation, but such an occurrence can only happen when the accident is attended with extensive laceration of the ligaments of the joint; in ordinary cases there is either an absence of motion, the displaced bone being firmly fixed in its new position, or the motion is so slight as to bear but a faint resemblance to that which is observed in fracture.

The pain, swelling, and loss of function, present in suspected fracture, are of no practical value, as similar phenomena are produced by other injuries, as contusions, wounds, sprains, and dislocations. Their occurrence being wholly accidental, must, therefore, not influence the surgeon in his attempt to form a correct estimate of the real nature of the case, or the relative value of the symptoms of this and other analogous affections.

*Mode and Time of Examination.*—Although the symptoms which have now been described will generally be sufficient, along with a careful consideration of the history of the case, to enable the surgeon to determine the diagnosis of this lesion, especially if he will take the trouble of comparing them with the symptoms of other accidents, I deem it, nevertheless, necessary, in concluding this branch of the subject, to say a few words respecting the manner of conducting the examination of the affected parts, as the ultimate issue of the case will greatly hinge upon this circumstance.

My experience satisfies me that few practitioners know how to examine

a broken limb. They take hold of it as if they were afraid of giving pain, or causing suffering, and the consequence is that the result is often most disastrous. I am far from wishing to be understood as being an advocate of rough surgery; on the contrary, no one abhors it more than I do, yet there are times and circumstances when the best interests of the patient demand that he should be most thoroughly examined, no matter what amount of pain he may be compelled to undergo. But there is no need any longer of such infliction now that we can prevent suffering by anæsthesia. The patient being rendered insensible, perquisition is performed at the surgeon's leisure, slowly and deliberately, and with an eye to the ultimate result, not forgetting self. The sooner such manipulation is instituted the better, for there will be less likely to be inflammatory swelling and other obstacles calculated to embarrass our progress and obscure the diagnosis. Fractures of the shafts of the bones will rarely afford any difficulty, inasmuch as their symptoms are generally so well marked that the most casual inspection will be sufficient for their detection. But it is different when the lesion involves their extremities. Here the most laborious and pains-taking examination sometimes hardly enables the practitioner to form an accurate judgment respecting the real nature of the injury. Under such circumstances, therefore, he must not content himself with one or two trifling explorations, but he must handle the parts again and again, until he has thoroughly established the diagnosis. If, after repeated trials, he is still in doubt, it is his duty to state this doubt to his patient, and to seek the advice of a professional brother in order to aid him in solving the question. By adopting this course, he will be more likely to do justice to his patient, and at the same time escape personal blame.

For the reason already assigned, the parts should always be examined as early as possible after the infliction of the injury; but I would make no exception where some time has elapsed, and a good deal of swelling has supervened; for it is impossible that a broken bone, or the parts by which it is covered, should do well as long as its extremities are displaced, and thus permitted to fret, irritate, and perhaps prick the muscles and other structures in contact with them. Hence, the sooner the fracture is adjusted or the parts are placed in their natural relations, the more likely will they be to do well, and escape the ill effects of inflammation. There are instances, however, where, as may be supposed, immediate interference might prove highly prejudicial, using the term immediate here with reference to the surgeon's first visit. The patient may have been neglected, or his attendant may have mistaken the nature of the case, and in this manner several days may have passed uselessly away. The limb is now found in a very swollen and painful condition, intolerant of the slightest manipulation, nay, perhaps in an erysipelatous condition. To make an elaborate examination under such circumstances would be highly improper; for it could not fail to aggravate the morbid action, and perhaps urge it on to gangrene. The hand is withheld; the limb is placed in an easy position, and antiphlogistics, both local and constitutional, are freely



plied ; when action has sufficiently abated, but not until then, the proper examination is effected, and the diagnosis, if possible, established.

The mode of conducting the examination varies. In the upper extremity the surgeon will usually be able to get on without any assistance, but in fracture of the thigh and leg it will often be necessary to make extension and counter-extension while the parts are subjected to methodical manipulation. When there is marked displacement, the merest touch of the hand will generally suffice to detect the nature of the lesion ; but, under opposite circumstances, the nicest digital exploration may be required before a satisfactory result can be obtained. In general, it will be necessary to make pressure and counter-pressure at the seat of the injury, and to rotate the portion of the limb below the fracture upon its axis. In this manner, especially if proper extension have been made, the ends of the fragments being brought in contact, may be made to yield the friction-sound, previously described, and at the same time display the full extent of their mobility. Another procedure is to grasp the two extremities of the suspected bone, and then, while the superior one is firmly held with the thumb and fingers, to roll the inferior upon its axis. If, while this is being done, both parts move together, the probability is that there is no fracture, but if the lower should move, and the upper remain stationary, there can be no doubt of the fact.

*Mode of Repair.*—The mode of repair in fracture is precisely similar to that of the soft parts, the only difference being the superaddition of the carbonate and phosphate of lime, or the earthy constituents of bone. In order, however, to be thoroughly understood, it is necessary to study it with reference to the situation and disposition of the ends of the fragments of the broken bone, as the rapidity and perfection of the cure are greatly influenced by the manner in which they are arranged and held together during the treatment. The more perfect this is, the more complete, generally, all other things being equal, will be the reunion. For practical purposes, the whole subject of repair may be considered as consisting of four stages.

The first stage, which, on an average, extends from the first to the eighth day, is one altogether of preparation, in which nature clears away the rubbish, and places the ends of the fragments in a suitable condition for the process of repair, properly so called. The blood which was extravasated at the moment of the accident, at and around the seat of the fracture, is in great degree, if not entirely, absorbed ; the inflammatory products, especially the intermuscular, are also disposed of ; the swelling subsides, the pain disappears, and there is no longer any tendency to spasmodic action, the muscles having become calm and quiet under their new relations. Any traumatic fever that may have been present will also be found to have vanished. Thus the part and system have happily passed through the preliminary stage of the reparative process.

If the parts be examined at the commencement of the second stage, it will be seen that the ends of the broken bone, as well as the periosteum, and the other soft parts in their immediate vicinity, are abnormally red and injected, and covered by plastic matter, resembling

very much in its color and consistence pale currant jelly, or a thick solution of isinglass. It is usually most abundant upon the surface of the bone, and is often sufficient to lift up the periosteum; a considerable quantity is also generally seen between the periosteum and the muscles, and even among the muscles themselves, all these structures being more or less actively engaged in the process of repair. A similar substance, but usually less abundant, is poured out within the medullary canal, the lining membrane of which is also in a state of inflammation, as is evinced by its discolored and injected condition. In the latter part of this stage, which lasts from the eighth to the twentieth day, the newly-effused matter, which differs in none of its properties from that which serves to unite a recent wound, becomes gradually more and more solid, until at length it assumes the consistence of a concrete substance.

The third stage is characterized by still further changes in the consistence of the effused matter, and by its gradual conversion, first into fibro-cartilage, then into cartilage, and finally into bone; or, more correctly speaking, cells are developed in the new substance, into which the osseous granules are deposited, the whole process bearing the closest possible resemblance to that which takes place in the formation of the original bone. The period at which the bony matter begins to be developed in the adult varies from the eighteenth to the twenty-fifth day, its appearance and progress being influenced by numerous local and constitutional causes, to be described under another head.

The ossific process proceeding in the way now described, two layers of bony matter are formed, one lying upon the outer surface of the fragments, the other within the medullary canal, each extending some distance beyond the seat of fracture (fig. 39). To these two strata is

Fig. 39.



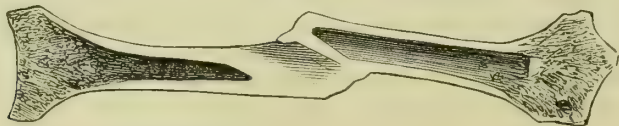
Fractured tibia, bisected, to show the formation of new bone beneath the periosteum, and within the medullary canal.

confided the office of temporarily supporting the fragments, or of holding them together until their ends are permanently united by osseous substance; a circumstance which does not take place, as a general rule, until several months later. To this new matter the older pathologists applied the term *callus*, in consideration of its hardness, which, when the process of repair is completed, is fully equal to that of the original bone, which it also closely resembles in its structure. From its office, the outer and inner callus, or that which invests the broken bone and lies in its medullary canal, is now universally known as the temporary or provisional callus, while that which is placed between the two ends of the bone, and thus serves to cement them together, is designated as the definitive or permanent callus. The temporary callus is, figuratively speaking, nature's splint, or the means which

she employs to support the fractured bone until the continuity of the fragments is re-established by the deposit and organization of osseous matter between their extremities.

As the first stage in the reparative process is one of preparation, so the last is one of completion; reunion having been effected, nature now busies herself in removing whatever is redundant or superfluous, thereby fitting both bone and muscle for the resumption of their respective functions. The provisional callus, having ceased to perform its office as a splint, is gradually brought under the influence of the absorbents, its more superficial portions being taken away first, and afterwards the more deep, until the broken bone regains not only its original form and volume but also its pristine smoothness, all evidence of fracture disappearing, excepting, perhaps, a little seam or ridge corresponding with the line of junction of the two fragments. While these changes are going forward upon the exterior of the bone, nature is busy at work in its interior, disposing of the provisional callus in that situation, and thus restoring the medullary cavity to its normal condition. This can only occur, however, when there has been perfect apposition of the ends of the fragments; for when the reverse is the case, the new bone remains permanently in the canal, as is shown in the following drawing (fig. 40), from a specimen in my collection.

Fig. 40.



Any cartilaginous or osseous matter that may have been formed between the periosteum and muscles, or among the muscles themselves, is likewise removed as a substance foreign to the part, and therefore useless, if not positively prejudicial.

It will thus be seen that the fate of the provisional callus is precisely similar to that of the plasma which is effused between the edges of a wound, both gradually disappearing as soon as their service can be dispensed with, or as soon as the parts have acquired sufficient firmness to enable them to maintain their connection. The period required for effecting these changes in a broken bone varies from a few weeks to several months, according to the circumstances of the case.

Such is a brief but accurate account of the several changes which attend the repair of bone in the more simple forms of fracture, when the ends of the fragments are thoroughly maintained in their natural relations. Under such circumstances there is but little need of provisional callus; the ends of the fragments soon inflame, and unite almost by the first intention. But it is seldom that a patient is so fortunate; on the contrary, the fracture being generally oblique, is subject to more or less displacement, thus compelling nature to provide a temporary splint by the formation of provisional callus. I do not believe, however, as has recently been so much insisted upon, that there ever is an entire absence of this kind of callus, however intimately the ends of the



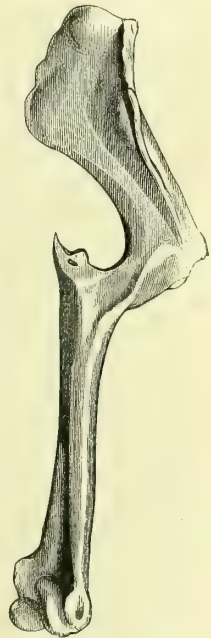
bones may be in apposition with each other. To prove the truth of this remark, it is only necessary to examine the numerous specimens of fracture of the skull and other portions of the skeleton in our museums; they will conclusively demonstrate that even the most simple fracture, unaccompanied by the slightest displacement, is never repaired without the development of a certain quantity of osseous matter upon its surface. At the same time it must be admitted that the provisional callus, in such cases, is very small, and that it bears no proportion to the enormous amount of substance that is so often formed when the ends of the bone are separated from each other. Under the latter circumstances, nature labors under great disadvantage, and is, therefore, obliged to make extraordinary efforts to effect reunion, which she can do only by the development of a large provisional callus. From these facts, then, we may deduce the general law that the quantity of new bone is always, other things being equal, in proportion to the contact of the ends of the fragments, being small when this is very accurate, and more or less large when it is imperfect.

When the ends of the bone are not accurately approximated, the first thing that nature does is to round off their edges, and to close the medullary cavity by a shell of new bone (fig. 41); the next, is the formation of a large provisional callus for the more secure consolidation of the fracture. The whole process is one of time and

Fig. 41.



Fig. 42.



labor, not of speed and ease, as in the former case. When the ends are completely separated but opposite, or nearly opposite, to each other, they are generally united by a bridge of new bone, extending from one to the other (fig. 42), and ultimately affording sufficient strength for the support of the weight of the body upon the affected limb. Or, instead of this, especially in elderly subjects, the junction is effected by fibrous, fibro-ligamentous, or cartilaginous matter. Finally, osseous union is not impossible when the extremities of the fragments overlap each other to an extent even of several inches, provided they are in contact; for in this case inflammation is established in the contiguous surfaces, followed, after a long time, by a large permanent callus. We see many curious specimens illustrative of this fact, though, in general, the union is ligamentous.

There are certain pieces of the skeleton in which

Fracture of the arm-bone of a chicken. From a specimen in my collection.

in fracture no provisional callus ever forms. Such are the olecranon, acromion, patella, and neck of the femur. Instead of uniting by osseous matter, as the other bones do, the cure is generally effected through the medium of fibrous, ligamentous, or cartilaginous substance, and the consequence is that the part commonly remains weak ever afterwards. Various causes conspire to produce this result, as the difficulty of maintaining the contact of the broken surfaces, and the inordinate secretion of synovial fluid, which, mingling with the effused plasma, thus impairs its vitality, and renders it unfit to become the nidus of bony deposit; but the most efficient one of all is the want of nourishment of the smaller fragment produced by the laceration of the nutrient vessels. Thus, in fracture of the neck of the femur within the capsular ligament, the upper piece, consisting of the head of the bone and of a portion of its neck, the only connection between it and the rest of the body, is by the round ligament, the arteries of which are altogether unequal to its proper support.

*Treatment.*—The leading indications in the treatment of fracture are to procure reunion and to prevent deformity. Before we proceed to speak of the manner of fulfilling these indications, it is proper that we should lay down certain rules for the transportation of the patient and the manner of preparing his bed.

Fractures are often received by persons at a considerable distance from their homes, either on the road, in the field, or at some secluded building. This renders it necessary to carry them to their own houses or to some hospital, in order to undergo the proper treatment. In fractures of the superior extremity, clavicle, scapula, or ribs, the requisite dressings may be applied at once; or, if this be not convenient, the patient may either walk or ride, the suffering limb being supported in a sling, or, as in the case of a broken rib, the body may be swathed with a long napkin. It is only, as a general rule, in fractures of the inferior extremity, spine, or pelvis, that the patient will require to be carried, and the best way of effecting this, if the distance be not too great, is to place him upon a narrow door, a long shutter, or two pieces of board, supported by two cross-pieces, the ends of which are intrusted to four assistants, a pillow and comfort having been previously put under the patient's head and body. Or, instead of this, the transportation may be conducted by means of an easy furniture-car, provided with a good mattress, and drawn slowly along in order to avoid jolting. Whatever mode be adopted, the limb should be temporarily splinted, and placed in as comfortable a position as possible, an intelligent person sitting by his side, and rendering such aid as may be required on the way. In carrying him to his chamber, four assistants will generally be necessary, two to support the body, which they do by crossing their arms behind the trunk, and interlocking their hands, and two for the lower extremities, the surgeon himself taking charge of the broken one.

A comfortable *bed* is to a man with a broken thigh or leg an indispensable article, and the practitioner who fails to give the proper instructions respecting it, is guilty of a gross dereliction of duty. Indeed, for his own sake hardly less than for that of his patient, he

should give prompt attention to this subject, inasmuch as it is impossible to effect a good cure without it. When we reflect upon the fact that in fractures of the lower limbs, the patient is often compelled to remain in the recumbent posture for weeks together, and how difficult it is, in most cases, to maintain the requisite extension and counter-extension, the force of this injunction cannot fail to be perceived in its true light. The essentials of a good fracture-bed are, first, firm and stout slats, instead of a cord or sacking bottom; secondly, a well constructed mattress of hair, moss, or cotton; and thirdly, a hole in the mattress, opposite the buttock, for the evacuation of the bowels, the opening being closed by a door of similar manufacture, and furnished with hinges and other appliances. If long confinement be necessary in one posture, or if the patient have been worn out by previous disease, an air-mattress may be required, in order to prevent bed-sores. If a sheet be used, its edges should be carefully secured to the sides of the mattress, otherwise it will soon become rumpled, and thus act as a source of annoyance.

It has been a question which has been much mooted in modern times, whether a fracture should, as a general principle, be set as soon as possible after its occurrence, or whether time should be allowed for the subsidence of the resulting inflammation. It appears singular that upon a subject so clear as this there should be any difference of opinion. It certainly requires no great knowledge of the nature of accidents to discover why such cases should receive the earliest possible attention; as long as the ends of the fragments are permitted to remain apart, their tendency inevitably must be to excite spasm and inflammation, thereby increasing the suffering of the patient and retarding his cure. Of this fact there can be no doubt, and hence my plan has always been to treat every case of the kind that has come under my observation as early as possible with the bandage and splint; applied, of course, not firmly, but gently and cautiously, simply with a view of giving support to the parts, and thus preventing further mischief from the sharp and projecting ends of the broken bone. I can hardly imagine an instance to which such treatment would not be adapted. I certainly have never seen one. We might as well expect that a man's limb would do well if it had a thorn imbedded in its muscles, as that it would be comfortable with two pieces of bone sticking in them. It is an absurdity to think it could be otherwise.

*Apparatus.*—Before an attempt be made to set the fracture, it is necessary to provide the requisite apparatus for effecting its maintenance. The means which are employed for this purpose are splints, cushions, bandages, and adhesive strips.

*Splints* are made of various materials, as wood, trunk-board, leather, felt, gutta percha, tin, and iron, according to the nature of the fracture or the fancy, whim, or caprice of the practitioner. In fracture of the thigh and leg, especially in that form which requires permanent extension and counter-extension, the best article is *wood*, adapted to the size and shape of the limb, at the same time that it combines lightness with strength. In fracture of the superior extremity, particularly of the humerus and of both bones of the forearm, splints made of *trunk-board*



generally answer best, as by a little manipulation, after immersion in hot water, they may easily be moulded to the form of the limb. A piece of pasteboard affords a capital support to a broken jaw or finger. Unoiled *leather* and felt, the latter being rendered stiff by gum shellac, make excellent splints, which I have often used with much satisfaction in fractures both of the upper and lower extremities. Previously to applying them, they must be softened in hot water, the sharp angles and edges having been pared off with a knife. The *tin case* I have employed a great deal, especially in fracture of the humerus at the elbow, and of the tibia at the ankle, ever since I entered the profession. *Iron splints*, in the form of the double inclined plane, are much in vogue in England; but in this country, little use is made of them. Many years ago, I was induced to make trial in a few cases of fracture of the condyles of the humerus and of both bones of the forearm, of a splint composed of light *wire*, adapted to the size and shape of the limb, but not answering my expectations, on account of its not being as manageable as I had been induced to expect, I soon abandoned it. For fracture of the bones of the hand and fingers, *carved splints* are sometimes employed. During the last twenty-five years an immense number of patented apparatus have been presented to the notice of the profession; but I am not aware that any of them have come into general use, or that they possess any particular advantage over the more common contrivances.

Splints made of *gutta percha* have recently come into vogue, not, perhaps, without reason on account of their neatness and easy adaptation. Cut into a proper shape and size, they may, after having been dipped in hot water, be readily moulded to the form of the part, which, upon cooling, they always retain. Previously to applying them, they are lined with wadding, or old linen, to prevent irritation of the skin, which this substance might otherwise induce.

*Fracture-cushions* are generally made in the form of small bags, stuffed with bran, fine chaff, cotton, wool, hair, moss, or any other soft material. They are designed to fill up the inequalities between the splints and the limb, and must necessarily vary in shape, length, breadth, and thickness, according to the exigencies of each particular case. Instead of cushions, simple pads or compresses are often used, especially in fractures of the superior extremities. For enveloping short splints, calico or muslin is employed; or, what I always prefer, sheet wadding. The same article answers admirably for filling up the inequalities between the short splints and the affected limb. Bags filled with sand are sometimes very convenient and useful, especially in fractures of the leg. Stretched along each side of the limb, they keep up steady, equable pressure, well calculated to prevent displacement of the fragments.

The fracture *bandage* should consist of coarse linen, calico, or muslin, and should possess sufficient strength to answer the purpose for which it is intended. Nothing is worse, or more likely to cause annoyance, than a thin, flimsy bandage. If the material is new, it should be washed before it is used, to rid it of its starch, and the selvage should be torn off to prevent it from exciting irritation, or producing welts in the

skin. The bandage most commonly used is the ordinary single-headed roller, of a length and breadth suitable to the affected limb or part of the body to which it is to be applied. In fractures of the leg and thigh, especially such as are of a complicated character, the bandage of Scultetus may often be advantageously employed, as it can be easily undone and reapplied without the slightest disturbance of the limb. It consists of numerous strips of the ordinary roller, of equal or unequal length, according to the size and shape of the part which they are intended to surround. In applying them, they are arranged in such a manner that one overlaps another nearly one-half.

The practitioner cannot observe too much caution in the use of the bandage in the treatment of fractures. It is an agent for good or for evil; for good, if applied properly; for evil, if applied improperly. Its object is twofold: first, to afford uniform compression of the limb, thereby preventing swelling and spasm; and secondly, to retain the necessary apparatus. Its application is governed by the general principles laid down in a former part of the work, the rule being always to begin at the remote part of the limb, and to proceed thence upwards some distance beyond the seat of the fracture, care being taken to put it on with sufficient tightness to fulfil the object for which it is designed, without incurring the risk of interrupting the circulation, or of doing other mischief. If it be too slack to support the parts in a proper and uniform manner, it will be useless; if, on the other hand, it be too tense, it will give rise to severe inflammation, swelling, and even gangrene. For the want of this precaution, many limbs have been lost, and a still greater number rendered permanently useless.

American practitioners are now much in the habit of employing *adhesive strips* in the treatment of fractures, either as retentive means, or for the purpose of effecting and maintaining extension and counter-extension. In their latter capacity, I was the first, I believe, to call attention to the subject, in my *Treatise on the Diseases of the Bones and Joints*, published in this city in 1830. I had witnessed their excellent effect in the practice of my former preceptor, Dr. Joseph K. Swift, of Easton, in a case of oblique complicated fracture of the leg, attended with so much injury of the soft parts as to interfere effectually with the employment of the gaiter and other counter-extending bands. The man had suffered a great deal of pain, until his patience was almost exhausted, when trial was made with adhesive strips, carried along the sides of the limb towards the knee, their free extremities being tied below the foot, to the transverse block connecting the two splints. Great comfort was the consequence, and the case progressed favorably from that time forward. Soon after I had occasion to use adhesive strips in a case of my own, with results equally gratifying. Since then I have employed this substance with great advantage in the treatment of fracture of the clavicle, olecranon, and patella, as well as in the treatment of fracture of the thigh and leg. Valuable papers have been published on this mode of management, within the last few years, by Dr. E. Wallace, Dr. Gilbert, and Dr. Neill, of this city, and Dr. Crosby, of New Hampshire. In a short article in the *Philadelphia Medical Examiner* for 1852, I also called attention to the

subject, giving very briefly the results of my experience up to that period. The importance of this agent, for the purposes referred to, will be fully pointed out under the head of special fractures.

*Coaptation and Dressing.*—Everything having thus been provided, and the requisite number of assistants obtained, the surgeon proceeds to restore the broken pieces to their original situation, or, to use a common expression, to set the fracture. This may be done either by simple manipulation, or pressure and counter-pressure, or by this means aided by extension and counter-extension. The former will usually suffice in fracture of the upper extremity, the jaw, and nose, while the latter will generally be required in fracture of the thigh and leg; in either case, the affected limb should be held as quietly as possible, not only during the adjustment of the fragments, but also during the application of the dressings. It need hardly be observed that these manipulations should be conducted in the most gentle manner, with an eye both to present comfort and future consequences. There is no department of surgery, where the humane practitioner may exhibit his skill and sympathy to greater advantage than in this, or where his conduct will be more closely watched and commented upon, than on such an occasion.

Extension and counter-extension are always necessary in oblique fractures of the thigh and leg, attended with displacement. By the term extension is understood the force which is required to draw the upper end of the lower fragment to a level with the lower end of the upper fragment, in order to place them in their natural relations; by counter-extension, on the contrary, is implied the resistance which is employed to prevent the limb, or even the body, from being dragged along by the extending power. The extension is generally made upon that part of the limb which is articulated with the lower piece, and the counter-extension upon that which is articulated with the upper. Thus, for example, in fracture of the shafts of the bones of the forearm, the extending power acts upon the hand, and the counter-extending power upon the arm, while in fracture of the body of the humerus the two forces are respectively exerted upon the forearm and the chest; and so in regard to fracture of the inferior extremity. When but little muscular resistance is anticipated, as in a child or feeble person, the extension and counter-extension may be applied directly to the two fragments, but at as great a distance from the seat of the injury as practicable. On the whole, however, I give the former method a decided preference, as it is much less likely to irritate and worry the muscles.

In reducing a fracture, the injured parts should be put in the most favorable position for relaxing the muscles, and the extending forces should be applied in as slow and gradual a manner as possible. If the limb be suddenly pulled, or stretched by fits and starts, the muscles which are concerned in effecting and maintaining the displacement will inevitably be thrown into violent spasmodic contraction, thus not only causing pain but, perhaps, severe injury to the soft structures, if not actually frustrating our intention. The degree of force which should be used in making extension must vary according to the amount and



character of the displacement, and the number and power of the muscles concerned in producing it; in all cases it should be sufficient to remove the shortening of the limb, or, what is the same thing, to restore it to its normal length, and to surmount every obstacle that opposes the reduction. The extension is always begun in the direction of the lower fragment, and is afterwards continued in that of the injured bone, until the object of its application has been attained. The ends of the fragments being now pressed into their natural situation, the fractured part of the limb is enveloped in a suitable bandage, and immovably fixed by splints, every hollow between them and the skin being filled with cotton, to ward off pressure. A sling, to suspend the hand and forearm, completes the dressing, if the fracture occupy the superior extremity.

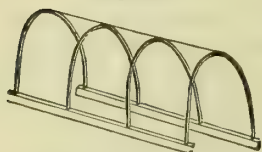
In fracture of the thigh and leg, the patient lies in bed until the ends of the broken pieces have become completely consolidated, or, at all events, until he has made such progress towards recovery as to admit of the use of the starch bandage, and of exercise in the open air upon crutches. During his confinement, the limb is placed in the most favorable manner for relaxing and resting the muscles which pass over the fracture; for this purpose it should be put in the extended position, and be well secured with apparatus designed to maintain permanent extension and counter-extension. In some cases the limb is placed in the semi-flexed position, over a double inclined plane, but such a course will seldom be necessary or proper, except, perhaps, in fracture of the upper part of the body of the thigh-bone, attended with great and obstinate displacement of the superior fragment, in consequence of the joint action of the psoas and iliac muscles. In transverse fracture of the patella, the thigh and leg are sometimes placed over a single inclined plane, the foot being considerably elevated above the level of the trunk.

*After-treatment.*—The fracture having been reduced and dressed, the patient is carefully watched, in order that he may be safely conducted through his long and arduous confinement. His diet, for the first few days, should be light and cooling, and the bowels should be opened, if necessary, by some mild aperient, as a dose of castor oil, Epsom salts, or citrate of magnesia. If fever supervene, the antimonial and saline mixture is freely used, aided, if the symptoms are urgent, and the patient is plethoric, by venesection, although such a procedure will rarely be called for. Action having subsided, the patient gradually resumes his accustomed diet, being still careful, however, to err rather upon the side of abstinence than on that of excess. Pain is allayed by anodynes. The bladder is relieved, if necessary, by the catheter.

During all this time the fractured limb is carefully watched, the patient being visited for a while at least once a day, or, if the case be at all troublesome, even twice a day, until all danger of mischief is over. If there be considerable pain and swelling, it will be well to remove the dressings at the expiration of the first twenty-four hours, otherwise they may be retained for some time longer. While I am an advocate for the careful watching of the dressings, I am opposed to frequent change, as calculated to produce injurious disturbance in the

ends of the broken bone, and impediment in the process of repair. If the first dressings have been applied lightly, as they always should be, and the parts be well seen to afterwards, it is hardly possible for the patient to do badly. The great danger, in nearly all cases, as far as the safety of the limb is concerned, is during the first week; that passed, there is seldom any risk.

Fig. 43.



In fractures of the thigh and leg, especially the latter, the limb must be carefully protected from the pressure of the bedclothes, by means of a contrivance, such as that exhibited in the adjoining cut (fig. 43). It consists of two pieces of wood, connected by several semi-circles of hoop, or wire, attached by a longitudinal piece.

In fracture of the superior extremity, the patient is often able to walk about immediately after the accident, taking out-door exercise, and, perhaps, even attending to business. But it is very different when he has a broken leg or thigh. Here, as a general rule, he is obliged to keep recumbent, often for a most unreasonable time, until, it may be, he is bedridden, and worn out with suffering. This is wrong. Such a case demands an immediate change of treatment. The starched bandage is substituted for the previous dressings, and the patient is sent out into the open air upon crutches. Prompt amendment follows; the general health rapidly improves, and the process of repair, having received a new impulse, steadily advances to completion.

As fractures are constantly liable to be followed by weakness and stiffness of the limb, the rule is to move the joint nearest the injury as soon as the union is sufficiently advanced to preclude the possibility of displacing the fragments or interrupting the consolidating process. This constitutes what is called *passive motion*, a most important element in the management of this class of lesions. It should not be commenced, as a general rule, before the end of the second week, and should be repeated once a day, or every other day, according to circumstances; it should be very gentle at first, and be gradually increased until the limb has completely regained its normal functions. During its performance the parts are properly supported by assistants, and the dressings are reapplied the moment it is over. The restoration of lost function will be greatly promoted by frequent washing with warm water and soap, followed by frictions with some sorbefacient lotion, as spirits of camphor, soap liniment, or weak solutions of iodine.

As soon as the callus has acquired sufficient firmness to sustain the ends of the broken bone, the splints and bandages are either discontinued, or applied more loosely, the object now being merely to keep the parts at rest until the union is perfectly consolidated. In fractures of the inferior extremity, some days should usually elapse before the patient is allowed to rise, or bear any weight upon the affected limb; the new bone is still weak, no definitive callus has yet formed, and the patient, awkward from long disuse of his joints, is liable to fall from the slightest accident. These precautions are ex-

tremely important, and should, therefore, always receive the most scrupulous attention.

*Immovable Apparatus.*—The treatment of fractures of the extremities may often be advantageously conducted with the immovable apparatus, concerning which so much has been said and written of late years as a comfortable and time-saving expedient. When this method of treatment was first announced, in 1834, by M. Seutin, of Brussels, it was almost universally regarded with suspicion, and even now, after the numerous trials that have been made with it in different parts of the world, it is questionable whether it is receiving the attention it merits. In this country it has been but little employed at any time, either in private or hospital practice. It is difficult to determine to what this neglect is attributable, whether to fear, to indolence, or to apathy. Many practitioners are afraid that the apparatus will do mischief; others feel themselves incompetent to apply it properly; while a third, and perhaps the most numerous class of all, reject it on account of the supposed trouble attending its use. Such objections are altogether frivolous. The accumulated experience of the profession during the last twenty years is sufficient to convince any one, even the most sceptical, of the safety and utility of this mode of dressing fractured limbs. It is not, of course, applicable to all cases; but if proper judgment be exercised in their selection there are few in which, in some stage or other of their progress, it will not be beneficial. I am myself averse to the early use of the immovable apparatus, convinced that the safest plan is always to wait until there is complete subsidence of the resulting inflammation and swelling. From ten days to a fortnight is a good average period for the commencement of its application; employed earlier, it may induce undue compression, and thus compel removal. I would, then, have an eye to time and circumstances; avoiding premature interference, on the one hand, and too long delay on the other.

The immovable apparatus may be prepared with various substances, all of them possessing more or less, though not equal, merit. Cowper, an English surgeon, employed compresses and bandages, saturated with a mixture of the albuminous part of eggs and wheat flour, which was replaced by Lawrence by powdered chalk. Seutin was the first to recommend starch; Velpeau uses dextrine; Smee prefers gum Arabic and whiting. Gum shellac and glue have also been highly lauded, and of late much has been said in commendation of the plaster of Paris bandage. Of these various articles the starch is perhaps the best; it certainly possesses the advantage of cheapness, and of being easily prepared, applied, and removed, as well as being always easily procurable.

The apparatus of Smee, called the *moulding tablet*, is also an excellent contrivance, nowise inferior to the starch, and but little more expensive. It consists of two layers of coarse, old sheeting, cemented together by means of a thick paste made by rubbing very finely powdered whiting with mucilage of gum Arabic. The sheeting soon dries, without shrinking, into a hard, firm substance, which, with the aid of a sponge and hot water, may afterwards be accurately moulded to the fractured limb, and worn with great comfort and efficiency.



*Dextrine* is a yellowish white, pulverulent substance, obtained from amylaceous vegetables and plants; it exists in union with fecula, amidine, diastase, and gum, and possesses remarkably glutinous, and adhesive properties, well adapted to the object for which it is employed. Besides, it is very cheap, and generally dries in one-sixth of the time that starch does. The only objection to it is the greater difficulty of removing it. It is converted into a paste of the consistence of thin molasses, with equal parts of water and camphorated spirits.

*Plaster of Paris*, originally employed by the Moors of Spain, was first tried in Europe, as a scientific dressing in the treatment of fractures, by Professor Kluge, of Berlin, in 1829. The bandage is prepared by rubbing the dry plaster thoroughly into the meshes of a thick muslin roller, the ends of which are sprinkled with water previously to the application. The great advantages of this dressing are the rapidity with which it dries and adapts itself to the parts, and the fact that it forms an unusually firm, hard casing, which permits the limb to be handled and moved with great ease during any transportation that may be necessary to place the patient in more comfortable quarters.

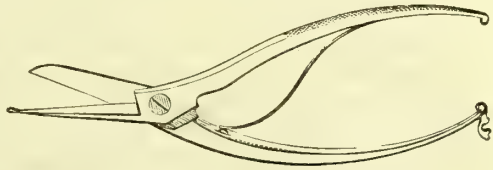
The *starch bandage*, which I myself prefer, on account of its simplicity and the facility of procuring it, is applied in the following manner: Supposing the leg to be the part injured, the first thing to be done is to procure a pint of starch, without any lumps, a bundle of wadding, several long rollers, two light binder's board splints, and an apparatus for maintaining extension and counter-extension until the dressing is perfectly dry. The fragments being accurately adjusted, the limb is surrounded, in its entire length, from the toes to within an inch and a half of the knee, with two layers of wadding, in order to protect its bony prominences from the pressure of the bandage. Special pains, moreover, are taken to fill up the hollows on each side between the ankle and the tendo-Achillis. A wet roller is now applied from below up in the usual manner, care being taken not to make the reverses over the edge of the tibia, lest they should occasion unpleasant, if not injurious, compression. A layer of starch is next put on, either with the bare hands or with a moderately stout paint brush, the substance being well rubbed into the meshes of the cloth. Resuming the roller, it is now carried down the limb as far as its extremity, when the starch is again applied, and so on until three layers have been formed. Two splints, made of binder's board, not too thick or heavy, and accurately shaped to the foot and leg, are steeped in hot water, and being carefully moulded to the parts, are secured with another roller, also thoroughly saturated and covered with starch. Finally, the dressing is completed by the application of a dry bandage. If the fracture is a very simple one, unattended with any disposition to displacement, as often happens when the tibia alone is broken, the limb is simply placed in an easy position upon a pillow arranged in the form of an inclined plane, or in an ordinary fracture-box; otherwise it will be necessary to use the apparatus of Desault, as modified by Physick, or some similar contrivance, in order to keep up extension and counter-extension until

the bandage is completely dried; an event which will seldom happen before the expiration of thirty, thirty-six, or forty hours, even in very hot weather, as the evaporation always proceeds with difficulty. The desiccation, however, may often be materially expedited by artificial means, especially by warm sand-bags stretched along the sides of the limb.

When the apparatus is perfectly dry it forms an immovable case for the limb, making equable and uniform pressure throughout, and maintaining the fragments of the broken bone accurately in apposition with each other. If the parts feel entirely comfortable, the patient may now sit up in bed or on a chair, or he may even walk about on crutches, the leg being properly supported in a sling. Generally, however, it will be found that there is for a day or two a sense of soreness, with, perhaps, some degree of throbbing, inviting recumbency rather than the erect posture. If the apparatus causes marked discomfort, by bearing unequally upon any portion of the limb, or if throbbing and swelling arise, immediate measures must be adopted for its removal. For this

purpose it should be slit up along the outer side of the limb, about an inch or an inch and a half external to the crest of the tibia, by means of Seutin's scissors, represented in the adjoining cut (fig. 44), one of the blades of which is probe-

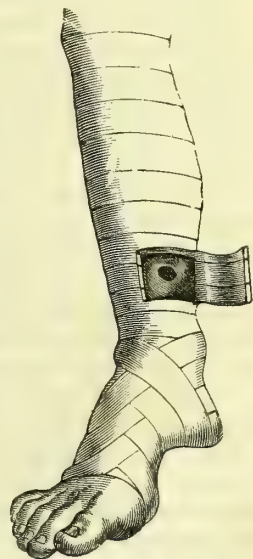
Fig. 44.



pointed, and therefore well adapted to the object. The limb being properly supported by an assistant, the hardened shell is gently peeled off from its surface, which is next carefully sponged with alcohol and laudanum, or spirits of camphor, when the apparatus is immediately reapplied with the aid of a roller. Thus, by simply removing the bandage from time to time, an opportunity is afforded of inspecting the limb, and ascertaining its precise condition, not only at the seat of fracture, but everywhere else.

If the fracture be seated high up in the leg, the apparatus should extend a short distance above the knee, as it then becomes a matter of great moment to keep the joint in as passive a condition as possible. In compound fracture, attended with discharge, a hole should be cut in the apparatus opposite the wound, so as to admit of the necessary drainage (fig. 45).

Fig. 45.



Great care should be taken that the edges of the splints do not produce any injurious compression; to obviate this, it is usually recommended that they should be torn instead of being cut, it being alleged that, when treated in this manner, they will be much less likely

to create mischief. My own experience, however, is that this is not the fact, and I, therefore, invariably bevel the inner edges with a stout knife, thus effectually preventing all risk of this sort.

It is not possible, also, to bestow too much attention upon the bandage; the care or negligence with which this is applied will make all the difference in the result, both as it respects the patient's comfort and the character of the cure.

The plaster of Paris bandage, prepared in the manner already mentioned, is applied in the same way as the starch, the limb having been previously enveloped in cotton wadding and a dry bandage. Great care is taken with the reverses and the various depressions of the limb. The bandage, moreover, must not be drawn with quite the ordinary firmness, allowance being made for shrinkage. Splints may usually be entirely dispensed with, especially if folded cloths, saturated with plaster, be applied whenever more than usual support is required, but extension must be kept up by assistants until the bandage is perfectly dry, as it always will be in a few minutes.

### 3. COMPLICATED FRACTURES.

The only class of fractures, besides the simple, which deserves to be considered under a distinct head is the complicated, as it is easy to comprise under this denomination every form of accident that can possibly arise either at the moment of the injury, or during the progress of the treatment. The propriety of this arrangement will become more obvious as we proceed with the discussion of the subject. In adopting this plan, I shall treat successively, and as concisely as possible, of fractures complicated with wounds, hemorrhage, dislocation, comminution of the bone, excessive laceration of the soft parts, erysipelas, pyemia, and, lastly, tetanus.

Complicated fractures may be oblique, transverse, or longitudinal, the frequency of their occurrence being in the order here enumerated. They are always caused by mechanical violence, as gunshot, falls from a great height, severe blows, or the passage of the wheel of a carriage, wagon, or railroad car. Complicated fractures from the latter cause have, of late, become very common, and are a frequent source of loss of limb and life.

The *symptoms* of this variety of fracture are, like those of simple fracture, sometimes extremely obscure, requiring great care and skill on the part of the surgeon to determine their character. In general, however, they are sufficiently well marked to enable him to distinguish them from such as attend other accidents, especially if an opportunity be afforded him of examining the parts before the supervention of much swelling. There is usually greater pain and shock than in an ordinary fracture, the resulting inflammation is more severe, and there is greater risk of violent secondary effects, as erysipelas, gangrene, copious suppuration, necrosis, caries, prostration, hectic irritation, and tetanus. In fact, complicated fractures are among the most serious occurrences that are met with in practice, being alike perplexing to the surgeon and dangerous to the patient; demanding the nicest judgment and skill for their successful management, and entailing,



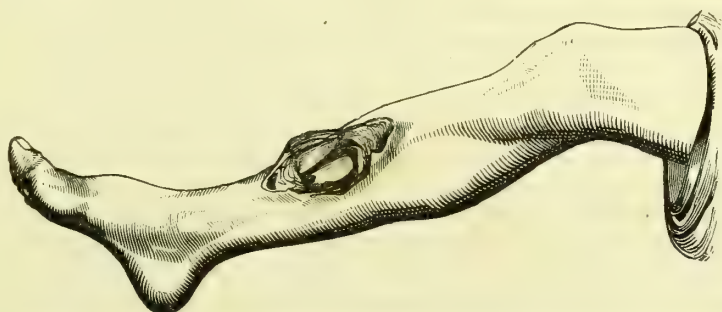
not unfrequently, the greatest possible suffering, horrible deformity, and loss of limb, if not also loss of life. It may be stated, as a general rule, that complicated fractures of the lower extremity are more dangerous and difficult of management than those of the superior, as well as more apt to be followed by distortion and permanent lameness.

The process of repair in complicated fracture proceeds on the same principle as in the simple form of the lesion, only that it is usually more tedious, and that it is attended with a larger quantity of callus. When there is a wound in the soft parts, the union is generally effected through the medium of granulations, which, arising from the ends of the fragments, ultimately assume the ossific disposition, and thus form the connecting link between them.

The treatment of this form of fracture varies according to the circumstances of the case, or the nature and severity of the complication; a fact which imposes the necessity of considering the subject somewhat in detail.

When the case is complicated with a *wound* in the soft parts, constituting what is usually called a *compound fracture* (fig. 46), and the

Fig. 46.



Fracture of the leg, complicated with wound and comminution of the bone.

limb is deemed capable of preservation, the first and most important consideration is the reduction of the fracture. This may generally be done by putting the limb in the most favorable position for relaxing its muscles, and by well-directed and gentle efforts at extension and counter-extension, along with proper manipulation, especially if the fracture be transverse, and the opening large; but if it be oblique, and there is a projection of one or both ends of the fragments, they occasionally fail, and compel us to resort to other measures. Under such circumstances, the soft parts which seem to gird or bind the bone, and prevent it from yielding, should be carefully divided, when a renewed attempt at reduction will probably be successful. Should every reasonable effort of the kind, however, prove fruitless, then, instead of leaving the bone in its exposed situation, where it would be sure to die, the proper plan will be to cut away a portion of it, especially if it terminate in a very long and narrow point.

Whatever may be the character of the wound, its edges should be carefully approximated by suture and plaster, aided by collodion to

exclude the air; or, instead of this, the wound may be covered with a light compress wet with blood, and supported by a bandage. In this way, a compound fracture may occasionally be speedily converted into a simple one, union sometimes occurring in a few days.

The *hemorrhage* in complicated fracture may be open or concealed, according as there is a wound or no wound; arterial or venous; insignificant or copious. In the first case, the bleeding will manifest itself in the usual manner, and is to be arrested by ligature or compression; in the second, it will be indicated, if it be at all considerable, by unusual swelling, attended with a sense of fluctuation or unusual softness, and by more or less discoloration of the integuments. If the principal artery of a limb has been severed, there will be an absence of pulsation in the parts below, with coldness of the surface. When no doubt remains concerning the diagnosis in such a case, the main trunk of the vessel is exposed some distance above the seat of fracture, and ligated; or, if this be deemed improper, an incision is made through the bloody tumor, and, its contents being turned out, the divided artery is sought and secured above and below the seat of injury. This, in fact, is usually the preferable procedure, especially as there must frequently be considerable uncertainty whether the effusion is arterial or venous; a circumstance which, perhaps, thus leads to the performance of a most serious operation in a case where one of a most simple character might suffice.

When the fracture is attended with a *dislocation*, the case necessarily assumes a very serious character, as it may give rise, especially if the joint involved be a large one, or the bone greatly shattered, to the question of primary amputation. In such an event the most experienced surgeon will often find it difficult to come to a prompt and correct decision. The principal circumstances which should induce him to make an attempt to save the limb are, the integrity of the patient's health at the time of the injury, together with a knowledge of his previous habits, and the simplicity of the dislocation, or the almost total absence of complication, as it respects the affected joint. If, on the other hand, the dislocation is compound, and the bone is badly broken, at the same time perhaps that it protrudes at the articulation; if all these injuries exist, or if, along with them, serious mischief has been inflicted upon the soft parts, as a violent contusion of the skin and muscles, or the laceration of important vessels or nerves, no doubt can be entertained respecting the propriety of the operation, and the sooner it is performed after the occurrence of reaction, the better it will be for all parties concerned. I believe that a compound fracture, extending into a large joint, as the knee or ankle, and attended with extensive rupture of the ligaments, muscles, and other structures should always, as a general rule, be treated in this way. It is true a case apparently of the most desperate character occasionally recovers, but such a consideration should not have too much weight, or induce us to neglect a measure which is sanctioned not less by reason than by experience.

When the case is not such as to demand amputation, the dislocation should always be reduced before an attempt be made to adjust the fracture. Great difficulty will sometimes attend such an operation, but

this may usually be overcome by patience and perseverance, aided by the means furnished by modern improvement. It is sheer folly to postpone the reduction of the dislocation until the bone has become sufficiently consolidated to enable it to bear the requisite manipulation; one of two things would be almost sure to happen in such a case, either a reproduction of the fracture, or an utter failure to replace the luxated bone.

The most common causes of *comminuted* fracture are, gunshot violence, railroad accidents, falls from a great height, and the passage of the wheel of a carriage. If the bone be broken into several pieces, and any of them are completely detached, or so loose as to render their reunion improbable, all such pieces ought to be carefully removed; after which the edges of the wound should be gently approximated, and kept in position by sutures and adhesive strips, covered with collodion. The limb being surrounded by the bandage of Scultetus, and supported by appropriate apparatus, is placed in an easy position, care being taken to moderate inflammation by the usual antiphlogistic means. If the wound suppurates, it must be covered with an emollient poultice or the warm water-dressing, with as little disturbance as possible to the broken bone.

When the fracture is complicated with violent *contusion* of the soft structures, the retentive apparatus should be applied rather slackly, and the parts be kept constantly wet with cold water, or, what is better, a strong solution of acetate of lead and opium. If the inflammation run high, recourse may be had to bleeding, purgatives, and antimonials. The limb is carefully watched, in order that prompt advantage may be taken of any change as soon as it arises.

In consequence of injury sustained by the skin, either at the time of the accident, or from the pressure of the bandage, the cuticle is sometimes raised in the form of little *vesicles*, containing a small quantity of thin, limpid, reddish, or yellowish fluid. Such an occurrence always awakens anxiety both in the patient and practitioner, especially if he be young and inexperienced, as it is apt to be associated with the idea of gangrene. From this, however, it may always be easily distinguished by the absence of lividity, severe pain, and other symptoms of excessive action. The proper treatment consists in puncturing the vesicles with a fine needle, and using the warm or cold water-dressing.

If the principal artery, vein, or nerve of a limb has been destroyed, at the same time that there is extensive laceration of the soft parts around, the case will probably require amputation, especially if there has been severe shock or extensive hemorrhage, with previous derangement of the general health. Such a case is, at all events, a bad one, liable to be followed by loss of limb, if not also of life. If, on the other hand, the principal artery retains its integrity in the midst of the torn and broken structures, and the patient is young and vigorous, although he may have experienced loss of blood, we should by all means make an attempt to save the limb, having previously explained to the patient and his friends the risk which such an undertaking involves. Some of the most gratifying results that reward the care and skill of the practitioner are cases of fracture complicated with



extensive laceration of the soft structures and comminution of the bone. I have several times succeeded in effecting excellent cures when, the main artery being intact, the limb hung merely by a comparatively small quantity of skin and muscle, and when I was compelled to remove a number of pieces of bone, or even saw off the ends of the fragments.

*Accidents after Complicated Fractures.*—Complicated fractures are liable to be followed by *erysipelas*, coming on usually within the first forty-eight hours after the occurrence of the injury. The disease is most apt to appear in persons of intemperate habits, and in such as are dyspeptic, or enfeebled by previous suffering, and generally adds very much to the danger of the case, perhaps already great before. Its extent and continuance will depend upon various circumstances, which will readily suggest themselves to the mind of the reader. The treatment is conducted upon general principles, our main reliance being upon the correction of the secretions, and the support of the system, by quinine, milk-punch, nutritious food, and anodynes, with the topical application of tincture of iodine diluted with equal parts of alcohol.

*Pyemia* is another effect of complicated fracture, but fortunately it is uncommon, at least in private practice, except when the accident has been caused by railway injury, the bursting of a gun, the passage of the wheel of a wagon, or some similar violence. It is distinguished by its usual insidious character, and generally sets in from the fifth to the tenth day, its approach being announced by violent rigors, alternating with flushes of heat, great depression of the system, delirium, and excessive restlessness. The structures which are most apt to suffer are the lungs, liver, spleen, joints, and connective tissues. The treatment is supportant and alterant; by quinine, brandy, and nourishing broths, for the former; by mercury, in moderately large and properly sustained doses, for the latter. In general, such cases fare badly, death occurring within a week from the commencement of the attack, despite our best directed efforts.

Another untoward occurrence, and the most serious of all, in complicated fractures, is *tetanus*, a disease which is particularly liable to supervene in nervous, irritable subjects, during hot weather, although it may take place at any season of the year, as well as in every description of individuals. It is a most formidable symptom, which should be promptly met by the removal of the affected parts, and by large quantities of anodyne and antispasmodic remedies. If occasionally a case is cured without amputation, it forms the exception, not the rule. In such an event, there is no time for delay; whatever is done must be done quickly and effectively, at the very inception of the disease, before there is any decided evidence of stiffness in the muscles of the jaw.

I have already incidentally adverted to the circumstances which are likely to call for primary amputation, and it may now be added that it should always be resorted to, as a general rule, whenever, along with a shattered or comminuted condition of the fractured bone, there is extensive laceration of the soft parts, with almost total disorganization of their substance. It is true, as was before intimated, that appa-

rently desperate cases are sometimes cured, and that limbs, so mashed and wounded as to render amputation the only probable chance of success, are now and then saved. But it is equally true that such instances are extremely rare, and if we take into account the protracted sufferings of the patient, and the likelihood of his ultimately falling a victim to his ailments, the reasons for performing immediate amputation are, to use the language of Mr. Percivall Pott, "vindicable upon every principle of humanity or chirurgic knowledge."

It is not uncommon for cases to occur in which the fracture is *multiple*, or in which the bone is broken at several points, but where the upper fracture is perfectly simple, and perhaps situated in a portion of the limb which it is desirable to preserve. Hence it becomes an important question how the surgeon is to act in such an event. To my mind, the subject is a very plain one. If it be really important to save the broken bone beyond the part that must necessarily come off, in order to make a longer and a better stump, there can certainly be no objection to such a course, provided, however, that the proximal fracture be perfectly simple in itself, and that there is no serious lesion of the soft structures, endangering limb and life by gangrene or other bad consequences. I have more than once adopted this plan, and have not, so far as I recollect, had any cause to regret it. No sensible surgeon would, of course, allow a bone to remain, under such circumstances, if it were comminuted, or if, the fracture being simple, there were serious injury of the muscles, integuments, or other important textures; to do so would only be to trifle with the safety of the case.

*Secondary amputation* will be necessary when, after an attempt to save a limb, and the employment of suitable antiphlogistic remedies, the parts become gangrenous; or when the consolidation of the fracture is prevented by profuse suppuration, and the patient is gradually wearing out by diarrhoea and colliquative sweats. In the first case, the operation is performed as soon as the mortification is arrested, and there is a distinct line of demarcation between the dead and living parts; in the second, as soon as it is perceived that the suppuration cannot be arrested, and that the patient has still sufficient strength to bear the pain and shock which must necessarily attend its performance.

*Statistics of Compound Fractures.*—We have no very copious statistics of compound fractures of different parts of the body. The following account, for which I am indebted to Dr. Frederic D. Lente, relates to cases of compound fractures of the lower extremities, treated in the New York Hospital from January, 1848, to July, 1857, the whole number being 392, fractures of the tarsus and metatarsus not being included. Of these, 68 occurred in the thigh, and 324 in the leg. Of the former, 3 involved both thighs, and of the latter, 16 both legs. Of the entire number, 190 were cured, 182 died, and 20 were relieved. In 39, or 20.5 per cent., amputation was performed.

Of the 68 fractures of the thigh, 18, or 26.5 per cent., were cured, and 2 relieved; amputation having been performed in 7. Of the 324 fractures of the leg, 175, or 54.0 per cent., were cured, and 14 relieved. In 35, or 20.0 per cent. of these, the limb was removed. Of the whole

number of cases of fracture, amputation was employed in 91, or 23.3 per cent., and of these 49, or 53.8 per cent., died.

Of 301 cases treated without amputation, 140, or 46.5 per cent., died, 3 having refused to submit to amputation.

Of the whole number of fatal cases, in which amputation was not performed, 74, or more than one-half, died within the first week; in many of these there was no reaction, and death ensued in from twenty-four to forty-eight hours.

Of 45 fractures of the thigh which occurred at or below the middle, 14 recovered, or 31.1 per cent.; while of eleven that occurred further down, 4, or 36.3 per cent., recovered.

Of 227 fractures of the leg, occurring at or below the middle, 130, or 58.1 per cent., recovered; of 30 above the middle, 17 or over one-half, got well.

Of 334 compound fractures of the thigh and leg, 164 occurred on the right side, and 170 on the left.

#### 4. INCOMPLETE FRACTURES, OR BENDING OF THE BONES.

The bones are liable not only to break, but also to bend (fig. 47). Such an accident can only happen in young subjects, principally in

Fig. 47.

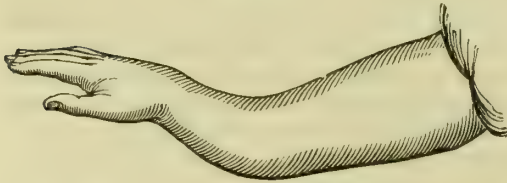


Fig. 48.



infants and children, in whom the osseous tissue containing a preponderance of animal matter, is comparatively soft, flexible, and elastic. Bending of the bones of the skull, especially the frontal and parietal, is occasionally witnessed at an early age, as an effect of external violence, as that, for instance, produced when a child falls, head foremost, down a flight of stairs, or out of a second story

window upon the pavement below. Under such circumstances, the cranial bones, at the part struck, are depressed beyond their natural level, and yet there is not, so far as can be ascertained, any fracture, strictly so called; they are merely bent or indented, and if no untoward occurrence take place, they will, generally in the course of a few days, resume their proper position by their own resiliency, aided, doubtless, by the locomotive action of the brain, propelling them outwards away from its surface. In an adult, an accident, capable of producing such a result, would almost certainly lead to fracture of the skull, and that probably of a very grave character; for the reason that the cranial bones, after a certain time, are always loaded with a large quantity of earthy matter, in the form of carbonate and phosphate of lime, the presence of which renders them more or less brittle, and thus pre-



disposes them to fracture. This tendency to fracture increases in proportion as we advance in years, and is, consequently, most distinctly marked in old age and decrepitude, in which the osseous tissue, almost destitute of animal substance, generally yields under the slightest force, the accident frequently eventuating in incurable injury.

Bending of the bones had been incidentally observed by a considerable number of practitioners, in the last century, and, indeed, even prior to that period; but the first systematic account of it was published in 1810, by Professor Jurine, of Geneva, Switzerland. In 1821, a short, but valuable article, illustrated by several graphic drawings, appeared on the subject in the fourth volume of the American Medical Recorder, from the pen of Dr. John Rhea Barton, of this city. More recently, attention has also been called to the affection by Professor Hamilton, of Buffalo, in his Report on the Deformities of Fractures, made to the American Medical Association in 1855, and also in an article in the New York Journal of Medicine for November, 1857.

I have myself met with this accident in nine cases, in children whose ages varied from three to eleven years, three being girls, and the remainder boys. Although it is most common in the ulna, radius, and clavicle, yet it also sometimes occurs in other pieces of the skeleton, as the humerus, femur, tibia, fibula, and ribs. External violence alone is capable of producing this lesion. I am not acquainted with any cases in which it was occasioned by muscular contraction. In fact, considering that bending of the bones is exclusively confined to children, it is hardly possible that the accident could arise from such a cause; certainly not, unless there existed extraordinary muscular development with remarkable flexibility of the osseous tissue, a condition of things hardly compatible with a healthy state of the system. In the bones of the forearm, which suffer more frequently than any other, the injury usually originates from force applied indirectly, as when, for example, a child, in the act of falling, instinctively throws out the arm to protect the body, and so receives the shock upon the hand, the concussion concentrating and exploding upon the radius, or the radius and ulna. In one of my cases, the bend was produced by the body of the child being suddenly propelled against his forearm at a moment when the elbow was planted upon the floor, and the wrist lying upon a stool. Flexion of the clavicle is the result either of direct violence, or of force applied to the top of the shoulder, especially if the body be at the same time propelled in the opposite direction, as in the case of a fall.

The *seat* of this lesion is variable; in the long bones, as those, for instance, of the forearm, it usually occurs a short distance below their middle, but it may also take place higher up, or further down. The radius and ulna may both suffer synchronously, but very frequently one alone is affected, or, if both are implicated, they do not suffer in an equal degree.

Judging from the cases of this accident that have fallen under my observation, I am inclined to believe that it generally happens without any particular predisposition, either constitutional or local. In every

instance of the kind, the subjects of the injury were in good health at the time of its occurrence.

What is the precise *nature* of this lesion? Is it really, as the name implies, a mere bending of the bones, or is it a flexion combined with partial fracture? These questions are easily answered. In very young subjects, as in children not more than a few years of age, and in the milder forms of the lesion, the osseous fibres are merely extended or stretched, so as to permit themselves to be drawn out of their natural course; in cases of an opposite character, on the other hand, there is no doubt that, while some of the fibres are bent, others are both bent and broken. These conclusions are beautifully borne out by the experiments of Dr. Hamilton upon the bones of young chickens, which, from the fourth to the sixth week, and consequently before the completion of the ossific process, could be readily bent without fracture to an angle varying from twenty-five to thirty-five degrees; whereas, the bones of older chickens, thus treated, always partially broke, their fibres being incapable of withstanding the force used in flexing them.

These partial fractures, sometimes called interperiosteal, from the fact that the fibrous envelop of the bones remains intact, bear a close resemblance, in the mode of their production, and the nature of the resulting injury, to the appearances presented by a green hickory stick, forcibly bent over the knee, but not to such an extent as to occasion any external sign of fracture, although it will be found, upon making a section of the wood, that many of its fibres have actually been broken, while others, and perhaps the greater number, have merely been bent.

The *symptoms* attendant upon this accident are pain and deformity at the seat of the injury, loss of power in the limb, and absence of crepitation. The pain varies in degree, being sometimes slight, at other times severe; swelling soon supervenes, and the part feels numb and heavy. A marked curvature, generally very gentle, but sometimes quite abrupt, always exists at the affected part, and can seldom be completely effaced without the application of very considerable force; indeed, often not without breaking the bone entirely across, especially if it was previously partially fractured. In the latter case, there is usually at the convexity of the curvature a slight depression, capable of receiving the point of the finger, its boundaries being formed by rough, sharp, bony fibres. Further than this there is no displacement, and under no circumstances is there any crepitation. The use of the limb is always greatly impaired, but not completely destroyed, as it commonly is in ordinary fracture. Finally, I may mention, as another highly important and diagnostic sign, the great difficulty which is so frequently experienced in restoring the parts to their proper position.

The *treatment* of these accidents must be conducted upon the same general principles as that of ordinary fractures. When the bones are merely bent, slight pressure and extension will usually suffice to accomplish restoration, the affected parts being compelled, as it were, to retrace their former steps. If flexion be conjoined with partial solution of continuity, the reduction will necessarily be more difficult, and may, in fact, altogether fail, owing to the manner in which the osseous fibres are interlocked with each other, and the inability which

is experienced in disengaging them, so as to induce them to slip back into their proper position. However this may be, the attempts to remove the curvature by extension and pressure should neither be too violent nor too long continued, lest they prove injurious. The object should be to restore as much as we can by gentle means; what cannot be effected in this manner, may well be left to the operation of time, the absorption of the broken and resisting osseous fibres, and the action of the muscles, which seldom fail to reinstate the parts, although from six to eight weeks may elapse before the final completion of the cure. I have generally found the use of leather splints, well padded, and accurately shaped to the limb, of great service in bringing the bones into their proper relations. When the accident is followed by undue inflammation, recourse must be had to the usual antiphlogistic remedies, especially leeching and cooling lotions.

There is a variety of partial fracture, known by the term *fissure*, which is peculiar to the bones of elderly subjects, no well-marked instance of it having ever been met with in infants and children. Such an occurrence, which is, in general, much more interesting in a pathological than in a practical point of view, is by no means uncommon in the skull, especially along its base, where it is always associated with severe, and frequently fatal, injury of the brain and its envelops. The fissures in many of these cases are most extensive, involving the sphenoid, occipital, temporal, frontal, and perhaps even the ethmoid and parietal bones. In the other pieces of the skeleton the occurrence is more rare; but examples are occasionally seen both in the long, short, and flat bones, as the result of external violence, generally directly applied, though sometimes indirectly. The accident is sometimes produced by gunshot injury. The lesion, however induced, consists essentially in a forcible separation of the osseous fibres, and exhibits itself in a great variety of forms; the crack sometimes extending through the entire thickness of a bone, at other times merely through its outer table, and at other times, again, involving both the compact and areolar tissues, but not passing completely through them. The length of the fissure varies, from a few lines to a number of inches, perhaps as many as six or eight, although this is exceedingly uncommon. The width of the crevice is generally very slight, perhaps barely sufficient to admit the blade of a penknife. In rare cases, as when it involves the extremity of a bone, it may gap somewhat, so as to give the part an appearance as if it consisted of two fragments, firmly adherent at one end. Finally, the fissure may be straight, curved, or angular.

Of the rarity of this lesion, as an uncomplicated occurrence, an idea may be formed when it is stated that there are probably not more than three or four well-marked specimens of it in all the osteological cabinets of this city. As a conjoint lesion, it is occasionally met with in compound fractures, especially when caused by railway accidents. There are no signs by which the nature of the injury can be distinguished during life; a circumstance which is the less to be regretted, because the treatment does not differ from that of ordinary wounds, fractures, and contusions, with which it is so generally associated.



## 5. DIASTASIS, OR SEPARATION OF THE BONES AT THEIR EPIPHYSES.

The extremities of the bones of young subjects are, as is well known, united to their shafts, or bodies, by means of cartilaginous matter, which, in some of the pieces, and in some individuals, does not assume the osseous form until after the twenty-first year, and occasionally, indeed, not until even a later period. Up to this time, consequently, these junctions are liable to be severed, so as to allow the contiguous extremities to separate from each other, and it is this occurrence that constitutes what is technically called diastasis (fig. 49).

Fig. 49.



Diastasis of the  
femur: reunited.

It is probable that this accident may occur in all parts of the skeleton united in this way, although there are doubtless some in which it is more common than in others. Its occasional existence has been recognized, by dissection, in the humerus, radius, femur, and tibia, and there are few systematic treatises which do not allude to it as being now and then met with in some of the other bones. The most common cause of diastasis is a wrench of the part, violent traction, or a severe fall. I am not aware that it has ever been produced by muscular contraction; and, on the other hand, it is rarely the result of direct violence, as, for instance, the kick of a horse, or the passage of the wheel of a carriage, such an accident more generally eventuating in fracture of the bones than in a separation of their epiphyses. The lesion may happen at any period of life, prior to the completion of ossification, but is most common from the fifth to the fifteenth year. Its occurrence in middle-aged and elderly subjects is, for the reasons already mentioned, impossible. Girls are more prone to it than boys, owing, probably, to the fact that they are more frequently exposed to its exciting causes. The affection, like fracture, may be simple, compound, or complicated. Cases are noticed in which the diastasis is blended with fracture of the shaft of the bone, and it is by no means uncommon to find that small processes of bone are dragged away with the epiphyses.

The *symptoms* of this lesion do not differ essentially from those of fracture. Its existence may generally be suspected when an accident affecting a bone occurs in a young subject, in the neighborhood of a joint; when the ends of the fragments are transverse, or nearly so; when the articular piece retains its position, while the other moves about; and lastly, when the crepitation produced by rubbing the ends of the fragments against each other is of an unusually dull, rough, grating character. Moreover, it will usually be found that the parts, when once reduced, are less liable to be dragged asunder by the action of the muscles than in case of fracture.

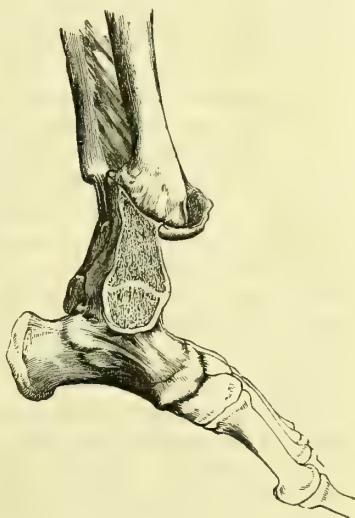
The prognosis is generally favorable, union taking place quite as promptly as in fracture. The treatment is also the same as in the latter accident.

## 6. UNUNITED FRACTURES.

Fractures occasionally refuse to unite, either in consequence of causes inherent in the part or system, or on account of mismanagement growing out of the surgeon's want of attention and skill, or else out of the patient's own misconduct. It is practically important that a distinction should be drawn between a fracture that unites tardily and one that does not unite at all, or only through the medium of a fibrous, ligamentous, or fibro-cartilaginous tissue. Slow consolidation is by no means uncommon; the parts may be loth to take on the requisite degree of ossific action, and the result may be that a fracture that is ordinarily repaired in four or five weeks, may, perhaps, be still imperfectly united at the end of twice that period. The process of restoration is only held in abeyance, neither advancing nor receding; by and by it begins again, and then often proceeds with its wonted rapidity. Such cases are frequently very trying to the surgeon's patience, but they generally turn out well in the end, provided sufficient care has been taken to preserve the parts in their proper relations. In the ununited fracture, on the other hand, the process of consolidation is either completely prevented, or, after having progressed for some time, is at length permanently arrested. Under these circumstances, the ends of the fragments are gradually rounded off by absorption, and remain either entirely loose and disconnected, or they become adherent through the medium of fibrous, ligamentous, or fibro-cartilaginous matter. Sometimes an adventitious joint is formed (fig. 50), provided with a more or less distinct synovial membrane, thus permitting the ends of the bone to move upon each other with greater facility.

Want of reunion in a fracture may depend upon a great variety of *causes*, some of them resident in the parts themselves, others connected with the system. Thus, it may be occasioned by the interposition of a clot of blood, or of a piece of muscle, tendon, or bone. An instance is mentioned where a fracture was prevented from becoming consolidated by the presence of a musket ball. Fragility, softening, and carcinomatous affections of the bones are usually enumerated as circumstances interfering with the reparative process, but it is not improbable that their influence has been greatly exaggerated; at all events, it is certain that, in many cases of this kind, the fracture unites as readily as when the bones are perfectly healthy. Too much motion, the long-continued use of cold water, especially in persons of a nervous, irritable tem-

Fig. 50.



perament, and tight bandaging, may also bring about this result. Some years ago, I saw a case in which, from the latter cause, the consolidation of a fracture of the thigh-bone was delayed for nearly a twelve-month. The limb had become excessively atrophied from the long-continued and injudicious use of the roller, and it was not until after it had been entirely laid aside, and the man had been permitted to exercise upon crutches in the open air, that nature seemed to consider herself in a fit condition to commence the process of reparation, from which she had been so long detained by this mode of treatment.

Old age is no barrier to reunion, provided the patient is in good health at the time of the accident, and the fracture is not complicated. I have met with several cases of fracture of the humerus, in persons after the eightieth year, in whom the consolidation took place in the usual time.

But the most common local causes of all of tardy reunion, in injuries of this kind, are a want of accurate apposition between the ends of the fragments and the existence of undue motion. Either of these circumstances will inevitably interfere with the consolidating process, and in many cases effectually prevent it, no matter in how favorable a condition the system may be for a cure. Hence, as stated elsewhere, the importance, nay, the absolute necessity, in every instance of fracture, of carefully guarding against these occurrences until the consolidating process shall be so far advanced as to enable the fragments, so to speak, to take care of themselves.

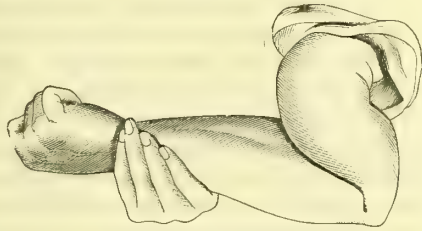
Fractures situated at or near the entrance of the nutrient arteries unite less rapidly than those situated further off, owing to the fact that they interfere more or less with the circulation and nourishment of the osseous tissue. It is easy to suppose that a laceration of these vessels, as occasionally happens both in simple and compound fractures, might be a cause of non-consolidation, especially when conjoined with other unpropitious circumstances. Statistics show that, when the supply of blood is cut off, to any considerable extent, so as to impose upon the periosteum the exclusive duty of nourishing the fragments, either one or both pieces will become atrophied, their walls being visibly thinned, and their areolar structure rarefied.

Want of union is sometimes dependent upon the *absorption* of the ends of the fragments, or even of the greater portion of the fragments themselves. A very singular case of this kind came under my observation not long ago, in a man, aged 53 years. When eighteen years old he received two simple fractures of the right humerus, at an interval of three months, one being situated about the middle of the bone, the other an inch and a half higher up. The first was repaired in the usual time, but the second refused to unite, the ends of the fragments becoming rounded off, as in the formation of an artificial joint; the process gradually proceeding, the whole bone was finally absorbed, nothing remaining except its condyles and a little of its head. The period occupied in the absorption was about six years, the general health being all the while unimpaired. The muscles of the arm are well developed, and, when thrown into powerful action, are capable of diminishing the interval between the shoulder and elbow to the



extent of several inches. Although the man is unable to perform any of the usual movements of the member, he can readily raise a weight of upwards of one hundred pounds, and can apply his hand to various purposes. The accompanying cut (fig. 51) represents the appearance of the limb during the contraction of its muscles.

Fig. 51.



Absorption of the humerus.

The principal *constitutional causes* which interfere with the reparative process are, debility, whether from loss of blood, want of nutritive action, or exhausting disease, as long-continued fever; a gouty, rheumatic, scorbutic, or syphilitic state of the system; and loss of nervous influence, however induced. Another cause, but one which, I presume, seldom exerts much influence, is pregnancy. It is barely possible to imagine that, during this state, there may be such an abstraction of blood from the affected parts for the nourishment of the foetus as to retard, and, perhaps, even temporarily prevent, the formation of callus. In the few cases of this kind which have fallen under my observation, I have not, however, witnessed such an effect, and I am strongly inclined to believe that this influence has been greatly magnified, if, indeed, it is not almost wholly chimerical. The same remarks are applicable to suckling. Another cause, probably much more efficient, as well as much more common, than the one just alluded to, is the protracted and inordinate use of ardent spirits, weakening the nutritive energies of the system, and rendering the blood and its vessels unfit for the performance of the important duties assigned to them in the reparative process.

Whatever the cause may be, great pains should always be taken to discover it, with a view to its early and efficient rectification. Should it consist in debility, however induced, the patient must at once be put upon the use of nutritious food and drinks, as porter, ale, wine, or brandy, aided, if necessary, by tonics, of which iron and quinine are generally the most eligible. A gouty or rheumatic state of the constitution is best remedied by purgatives, acid drinks, and colchicum. Tertiary symptoms should be met by iodide of potassium, either alone, or in union with mercury, the latter of which should sometimes be carried to the extent of slight ptyalism. Debility from drunkenness must be counteracted by the judicious employment of ardent spirits, such, if possible, as the patient has been in the habit of using previously to the accident.

The local treatment must be regulated by the circumstances of each particular case. The precise cause of the tardy or imperfect union must, if possible, be clearly ascertained, and immediately remedied by appropriate measures. If it depends upon too much motion, greater quietude must be insured; any defect of contact must be redressed by a more accurate adjustment of the ends of the fragments; cold applications, if injurious, must be discontinued; and any extraneous inter-

vening substance must be removed, either by calling into requisition the agency of the absorbent vessels, by pressure and other means, or, as in the case of a piece of dead bone, by the knife and forceps. The cause of the defective union having been thus remedied, the case will be likely, of its own accord, to proceed to a favorable termination, the ordinary principles of treatment being, of course, observed.

The principal local remedies, beside those above mentioned, are:

1. *Cutaneous friction*, either dry or moist, by means of the bare hand, or with a piece of flannel. If moist, various liniments, lotions, or unguents may be employed, and often with decided benefit, inasmuch as they tend to excite capillary action in and around the ends of the fragments, thus promoting the formation of callus.

2. *Compression* performed by splints of leather, or binder's board and the bandage; or by an apparatus expressly constructed for the purpose, and intended to concentrate the pressure at the seat of the fracture. The compression must, in all cases, be steady and persistent, as well as uniform and gentle.

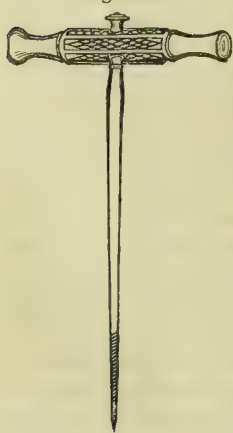
3. *Blisters* and *iodine* may sometimes be beneficially employed. Their application is particularly indicated when the want of union is dependent upon undue vascular excitement, and is, of course, entirely restricted to cases of recent standing.

4. *Friction* of the ends of the fragments against each other, as recommended by Celsus, and practised by modern surgeons. It should be performed very gently, and be repeated every four, six, or eight days, according to its effects, care being taken to keep the limb at rest in the intervals by an appropriate apparatus.

5. *Acupuncturation* with a long, slender needle, may be tried; or a small incision may be made over the seat of the injury, and a heated wire thrust between the ends of the fragments.

6. *Cauterization* of the integuments over the seat of the fracture with some caustic alkali, as recommended and successfully employed, in 1805, by Dr. Hartshorne, of this city; or exposure of the ends of the bone, and rubbing them over with nitrate of silver, as practised by several modern surgeons.

Fig. 52.



7. *Subcutaneous division* of the ligamentous bands between the two ends of the fragments has occasionally been successfully practised. The operation is performed with an ordinary tenotome, care being taken to cut the parts as thoroughly as possible, especially over the extremities of the broken pieces.

8. The introduction of *ivory pegs*, as originally practised by Dieffenbach, about two inches in length, conical in shape, and inserted into the ends of the fragments, previously pierced with a gimlet (fig. 52). They must be forcibly driven into the openings, and be retained until the consolidating process is well advanced. Excellent and rapid cures often follow this plan.

9. The *seton*, introduced into practice in 1802,

by Dr. Physick, is ordinarily, in obstinate cases, the most certain method. It should be passed between the ends of the fragments by a long, thin, flat needle, sharp and lancet-shaped at the point; or, when this is impracticable, as near the site of the fracture as possible, for experience has shown that this mode of performing the operation is nearly as successful as the usual procedure. The foreign body is retained for a variable period, longer in some cases than in others, and generally until it has excited suppurative action. The patient is carefully watched; and if the pain and swelling become severe, the seton is at once withdrawn. Immediately after the introduction, the fragments are properly adjusted, and steps taken, if necessary, to maintain extension and counter-extension. In the first case in which this treatment was employed, the seton was retained many weeks, and the patient recovered the perfect use of his limb. The practice of withdrawing the seton at the end of a few days, as advised by some, is, I think, objectionable, for the reason that it will hardly have sufficient time, in such a case, to excite the requisite degree of inflammatory action.

10. *Perforation* of the ends of the bone by means of a peculiar instrument, an operation proposed, in 1853, by Professor Brainard, of Chicago, is sometimes serviceable. It consists in piercing the extremity of each fragment at several points of its extent, and cutting up the intervening tissue, with a view of exciting ossific action. The instrument is introduced in such a manner as not to wound any important structure, and is not withdrawn until the bone has been perforated in several places. The puncture is then covered with collodion, and is repeated once a week, or every ten days, until the parts have become reunited, the limb being in the meantime kept quietly at rest in splints. The operation of Dr. Brainard seems to me to be better adapted to cases of tardy union than to the ununited fracture, properly so-called. I have tried it in several instances of the latter description, but have not succeeded in effecting a single cure. Instead of a special perforator, I have always used, with great facility, an ordinary medium-sized trocar.

In the Chicago Medical and Surgical Journal for September, 1858, Dr. Brainard has reported thirteen cases of united fractures, all successfully treated by his method. Five of the cases occurred in the femur, three in the tibia, and five in the humerus.

11. Finally, *excision* of the ends of the fragments, an operation devised, and first performed, in 1760, by Mr. White, of England, is occasionally employed. Such an operation, however, should never be resorted to without due deliberation, and until after the failure of the more ordinary and simple means. To say nothing of the difficulty of its execution, it is by no means devoid of danger; indeed, it has not unfrequently proved fatal. A very free incision is made through the soft parts down to the ends of the broken bone, which are then brought out at the wound and retrenched, either with a stout knife, a saw, or a pair of pliers. Sometimes the mere removal of the cartilaginous crust is sufficient for the purpose, an object which may be easily accomplished by scraping.



To maintain the freshened ends in accurate and steady apposition, it was proposed by Horeau, in 1805, to connect them together by means of a wire, and to retain them in this position until the completion of the cure. The procedure, which has, I believe, been generally condemned by European practitioners, has been frequently employed in this country, in consequence, apparently, of the high authority of Dr. J. Kearney Rodgers, who was the first to perform it on this side of the Atlantic. It consists, first, in cutting off the rounded ends of the fragments; secondly, in drilling a hole through each; and lastly, in tying them firmly together with a silver wire, so as to keep them closely and evenly in contact during the consolidating process. It is generally imagined that this procedure is necessarily followed by violent inflammation, jeopardizing both limb and life; but this is an error. If the operation be carefully performed, and the after-treatment conducted upon proper principles, I believe that it will commonly be found to be entirely free from danger, while the utmost confidence may be placed in its efficacy. In the only instance in which I have had an opportunity of employing this method—in a case of united fracture of the humerus of eleven months' standing, in a young man twenty-two years of age—the patient experienced very little pain, inflammation, or fever, during any stage of the treatment, and the result was, in every respect, most satisfactory. The following is an outline of this case, as drawn up by Dr. S. W. Gross, for the Louisville Medical Review, July, 1856. It may be premised that the fracture was situated about three inches above the condyles, and that various remedies, among others Dr. Brainard's, had been faithfully but fruitlessly employed for its relief.

The patient being placed under the influence of chloroform, a longitudinal incision, about three inches in length, was made on the posterior aspect of the arm, through the triceps muscle, over the site of the fracture. The lower fragment was found to overlap the upper about an inch and a half. The ends of the bone were surrounded by a strong fibrous membrane, which was firmly adherent to the neighboring parts, and formed a sort of shut sac, in which the bone was embedded. About an inch of the lower portion of the upper fragment, and half an inch of the upper portion of the lower fragment, were removed with a delicate saw; but on account of their firm adhesions, and especially the shortness of the inferior piece, some difficulty was experienced in bringing them entirely into view. The fragments were conical, rounded, smooth, and invested with a thick, fibrous periosteum: no synovial membrane or fluid existed. The next step of the operation consisted in drilling the extremities of the bone, which having been done with a common gimlet, a piece of wire was introduced, to maintain them in apposition. The ends of the wire were twisted together, and allowed to protrude from the wound, the edges of which were brought together by three sutures and adhesive strips. Two splints and a roller being applied, the arm was firmly supported in a sling. There was very little hemorrhage, and no vessel required ligation. As the patient suffered a great deal of pain, a grain of morphia was given immediately after the operation. Very little constitutional

disturbance followed. Nearly all the wound healed by the first intention, and at no time was there much swelling, discoloration or suppuration. At the end of the eighth week, the process of reunion had advanced so far that there was scarcely any perceptible motion.

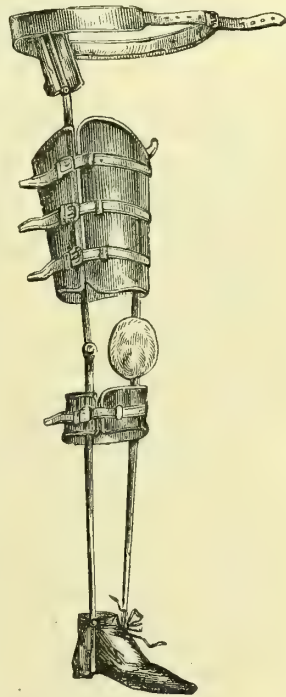
In a fortnight after this, the wire being removed, the patient went home perfectly restored, the arm being about an inch and a half shorter than the sound one. It is proper to add, that, by frequent passive motion, the elbow-joint was gradually regaining its original function.

The results of some of the above operations have been placed in a striking and interesting light by the statistics of Dr. Norris. Thus, in forty-six cases in which the seton was used, thirty-six were cured, three died, three were partially relieved, and five experienced no benefit. Of thirty-eight cases of resection, twenty-four were cured, six died, one was partially cured, and seven received no benefit. Of eight treated by cauterization of the ends of the fragments, six were cured. Of eleven cases in which friction was employed all were cured. It is worthy of remark that the treatment by the seton is less successful in fracture of the femur and humerus, than in that of any other bones. The danger of the more severe operations, especially the seton and resection, follows the same laws as in amputation, increasing with the size of the limb and its proximity to the trunk.

Whatever plan of treatment be adopted, it is impossible to be too attentive in the after-management of the case, especially in securing repose and accuracy of apposition to the ends of the fragments. The limb should be promptly put up in appropriate splints, which should be taken off from time to time, and carefully readjusted, just as in the treatment of a recent fracture. If the affected bone be one of the lower extremity, as the femur or tibia, it will be well to let the patient walk about in the open air upon crutches, particularly if he have experienced much constitutional change, the limb being supported by the admirable contrivance of Professor Smith, of the University of Pennsylvania. The apparatus, as seen in the accompanying sketch (fig. 53), is constructed upon the same principles as the ordinary club-foot apparatus, consisting of a shoe, and of a leg and a thigh piece, connected by hinges, and fastened round the limb by straps and buckles.

If any of the more severe operations are performed, the treatment, for the first few days, must be strictly antiphlogistic, the patient being most carefully watched, lest the inflammation, running too high, may induce fatal consequences. If abscesses form, they should be promptly opened, and the greatest attention should, throughout, be bestowed upon cleanliness.

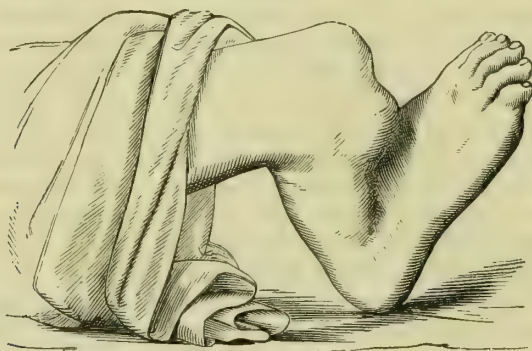
Fig. 53.



## 7. VICIOUS UNION OF FRACTURES.

In consequence of inattention of the surgeon, or a want of co-operation on the part of the patient, the ends of a broken bone sometimes unite in a very unseemly and injurious manner, entirely at variance with the beauty and usefulness of the affected limb (fig. 54). The

Fig. 54.



deformity thus arising may be produced by the overlapping of the extremities of the fragments, attended, of course, with corresponding shortening; or it may be owing to the imperfect contact of the two ends, thus occasioning a certain amount of angular displacement, without any abbreviation of the length of the bone. In whatever way the deformity may be induced, it is obvious that it should be rectified at the earliest possible moment; for the longer the case is permitted to remain on hand, the more difficult it will be to afford relief. There are several procedures by which this object may be attained: 1st. Compression and extension; 2d, forcible flexion, or rupture of the callus; and 3dly, resection of the ends of the fragments. These methods are not, of course, all equally applicable in all cases.

1st. The safest, as well as the most simple, procedure, but one which is applicable only in the more early stages of vicious union, consists in applying pressure opposite to the seat of the deformity, in the direction of its convexity. This may be efficiently done by means of appropriate splints and bandages, or with an apparatus specially constructed for the purpose, provided with pads and screws, and appliances for making extension and counter-extension, particularly if there be marked shortening. It is not necessary to give any descriptions of these contrivances, as they may be readily fabricated by any ingenious mechanic, or even by the surgeon himself. No preliminary treatment will be required. It is nonsense to suppose that we can soften the callus by cataplasms and fomentations in such cases. The compression and extension should be made, at first, in as gentle a manner as possible, and be gradually increased and steadily maintained up to the point of easy tolerance, being occasionally intermitted if productive of pain, or likely to induce excoriation.



2dly. If the preceding method fail, or is inapplicable, recourse may be had to forcible extension, or rupture of the callus, thus compelling the displaced fragments to retrace their steps. This plan also is chiefly applicable to recent cases, but occasionally it has been employed at the end of six, eight, ten, or even twelve weeks. I have myself successfully employed it at the expiration of the second month, and repeatedly within the first three weeks. It would be difficult to say when it should be refrained from; much will necessarily depend upon circumstances, for in one case the union may be firm in a month, while in another, perhaps equally simple, if not more so, twice or thrice that period may elapse before it becomes consolidated. Perhaps as good a guide as any would be the existence of slight mobility between the ends of the fragments; if the union is very strong, the attempt to break it might be attended with fracture of the bone above or below the seat of the callus, and so complicate the case. Besides, the operation, except in the more simple forms of the affection, should not be undertaken without some preparation of the system, as it is occasionally followed by violent inflammation, erysipelas, abscess, and even death.

The operation is easily performed, before the union has become consolidated, simply by bending the limb over the knee, the patient being completely narcotized by chloroform, or by placing it upon a table, and applying pressure upon the distal extremities of the fragments. When the case is of long standing, and the union firm, the callus can only be broken by the employment of force applied by some special apparatus, designed either to act directly upon the callus, or by means of a weight appended to the distal extremity of the bone, the fractured part projecting slightly over the edge of the table, while the portion of the limb containing the upper fragment is carefully held down by assistants. It has been ascertained by experiments, performed by Jacquemin, Bosch, (Esterlen, and others, that the callus of a thigh-bone, broken fifty days previously, will require a weight of from fifty to sixty pounds to sever the fragments at the seat of the callus.

3dly. Other means failing, the only resource that remains is *excision* of a portion of bone at the seat of the fracture, along with a portion of the callus. With this procedure, the origin of which dates back to the early part of the sixteenth century, and which was revived in the early part of this, are associated the names of a number of distinguished surgeons, both in Europe and in the United States; in the latter, those of Parry, Stevens, Mütter, Barton, and Pancoast, nearly all of whom have performed the operation successfully. The operation consists in exposing the extremities of the broken bone, and removing, with the saw or pliers, a sufficient piece to admit of accurate coaptation of the raw surfaces. The case is afterwards treated as one of ordinary compound fracture.

Finally, when relief is impracticable by any of the means now described, and the limb is sadly in the way of comfort and usefulness, the individual being perhaps obliged to labor for his daily subsistence, the only alternative is either to abandon him to his fate or to resort to amputation.

In 1851, I met with an instance of compound fracture of the tibia,

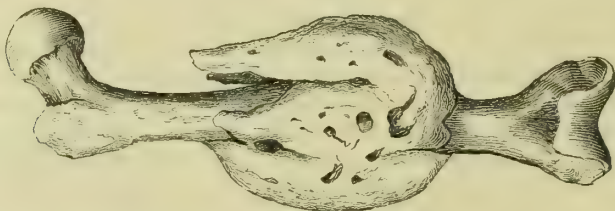
in a young man of nineteen, in whom about two inches of that bone, near its middle, had been shot away, two years previously, by a rifle ball. The fibula had remained intact, and with the aid of a stiff leather splint, forming a case which reached from just below the knee to within a short distance of the ankle, progression was performed with tolerable ease, though not without the use of a crutch. If the deficiency of bone had been somewhat less, I should have been tempted to cut away a portion of the fibula, and after refreshing the end of the tibia, to approximate the bones by silver wire; fully anticipating a good cure.

#### 8. DISEASES OF THE CALLUS.

The callus, like all new tissues, is liable to different diseases, both during its development and after its completion, more or less hostile to its welfare and perpetuity. Some of these affections have a local origin, some depend upon the state of the constitution, and others again, seem to partake of the nature of both of these. Deficiency of the callus, although not, properly speaking, a disease, may, nevertheless, become a source of great difficulty on account of its inability to subserve the purpose of a supporting medium. The causes which may induce this condition, and the means of remedying it, when it exists, have already been pointed out.

An exuberant callus is by no means uncommon; it occasionally arises without any obvious cause, but more generally it is dependent upon the separation of the ends of the broken bone, as if nature were determined to effect union, despite of the neglect of the surgeon. The annexed cut (fig. 55), from a drawing of a specimen in the possession

Fig. 55.



of Professor Cobb, formerly of the University of Louisville, affords a graphic illustration of an excess of this substance, obviously produced in this way. It is one of the most remarkable preparations of the kind that I have seen. The fracture, which was oblique, and situated just above the middle of the right femur, had evidently occurred several years before death. The callus, exceedingly porous in its structure, and very brittle, is eleven inches in circumference at the widest part, by six inches in length. From its superior extremity are detached two processes, which overlap the upper fragment, and must have materially impeded the action of the muscles of the limb.

Exuberance of the callus is occasionally produced by the presence of pieces of dead bone, which it thus incloses as foreign bodies are

sometimes inclosed by a cyst, or a wall of plastic matter. The sheath thus formed, however, is always imperfect, openings existing in it in different parts of its extent for the purposes, apparently, of drainage. Neglected or badly-treated comminuted fractures, caused by gunshot, railway, and other severe injury, are not unfrequently followed by an extraordinary redundancy of callus; and as the effect of this substance is to incarcerate the fragments of the broken bone, profuse discharge, generally of an unhealthy, fetid, and sanious character, may be thus kept up for almost an indefinite period. The proper remedy obviously is the extraction of the dead fragments, a procedure occasionally of a very embarrassing character, especially when the callus is situated in a bone thickly covered by muscles, or in close proximity with important vessels and nerves. In the case of Lieut. Adams, of the United States Marine Corps, I removed not less than twenty-three pieces of this kind, some of them of considerable size, having previously made a long incision over the tumor in front of the thigh. With the aid of chisels, gouges and pliers, riddance was effected with but little loss of blood, and with no pain, as the patient was thoroughly under the influence of chloroform. Although the number of dead pieces was unusually great, yet such was the size and firmness of the callus that, notwithstanding it was obliged to be divided in almost every direction, no separation of the ends of the broken bone ensued, and the patient, after having recovered from the immediate effects of the operation, was able to walk about as before. It is proper to add that the fracture had occurred nine months previously from a blow by an escopette ball.

The callus is subject to extraordinary *brittleness*, arising from an excess of earthy matter. Such an event may occur at a comparatively early period, as a result of causes whose true nature is not always easy of detection. I believe, however, that fragility of the callus is more frequently met with in persons of a gouty, rheumatic, and syphilitic state of the system, than in any other class of individuals. However induced, the slightest injury, as a mere twist of the bone, or even muscular exertion, is generally capable of fracturing it, and, consequently, of re-separating the ends of the fragments.

Finally, callus is subject to *softening*, disintegration, and absorption, if not, also, to the fatty degeneration. The causes under whose influence these changes are effected are not always, or, perhaps, even generally, distinguishable. In some cases they are plainly due to undue compression, as from tight bandaging; in others, they are induced by premature exercise. Occasionally, the absorption can be distinctly traced to the inordinate use of mercury, carried to profuse salivation; or it may be owing to a syphilitic taint of the system, especially when this affection has reached its third stage, in which the bones and periosteum are so constantly, and often so seriously involved. But the most common cause, perhaps, of all, is an impoverished and diseased state of the blood, from the use of improper food, and especially from the want of a sufficient quantity of fresh vegetables and subacid fruits. The influence of ill health arising from this cause upon the condition of the callus, was strikingly exemplified in Lord Anson's voyage to the



Pacific Ocean, in which many of the crew suffered severely from scurvy. It was noticed that those who had formerly had fractures were attacked with absorption of the callus, speedily terminating in disunion of the ends of the broken bone. Cicatrices, whether the result of the healing of wounds or of ulcers, experienced a similar fate, the parts breaking out into open sores, remarkably pale, languid, flabby, and difficult of cure. Similar effects are occasionally observed to follow attacks of typhoid fever and anemic states of the system, however engendered.

The treatment of softening and breaking down of the callus must depend upon the nature of the exciting cause, due inquiry into which should, therefore, always be made as a preliminary step. Tight bandages and splints are removed; premature exercise is avoided; iodide of potassium and mercury are administered if the cause is obviously of a syphilitic nature; scurvy is relieved by a change of diet, especially the use of subacid fruits and vegetables; and anemia is met with tonics and stimulants, as iron and quinine, with milk punch and nutritious food.

#### SECT. XVI.—FRACTURES OF PARTICULAR BONES.

##### 1. HEAD AND TRUNK.

##### FRACTURES OF THE NASAL BONES.

Falls and blows are the causes of this fracture, which may be either simple or complicated; oblique, transverse, or longitudinal; limited to one bone or extended over both. It is usually attended with severe injury of the soft parts, and sometimes with fracture of the ascending process of the superior maxillary bone. Occasionally, again, but more rarely, there is a separation of the nasal cartilages, or fracture of the ethmoid bone, the vomer, or turbinated bone. The symptoms are generally well marked, except when there is considerable swelling of the integuments, in which case the nature of the lesion may easily be overlooked, perhaps much to the detriment of the patient. If an examination be made soon after the occurrence of the accident, the nose will be found to be out of shape, from displacement of the fragments, one of which may be depressed towards the nostril, while the other may form an unusual prominence beneath the skin. Crepitation is also commonly distinguishable, especially if the fracture be multiple, or the bone broken into several pieces. In all cases, the point of the finger should be passed over the surface of the nose, with a view of ascertaining whether there be any irregularity or mobility, as there will be almost sure to be if there is a fracture. If, after this, there be still some doubt, it will be well to introduce a large probe, metallic bougie, or grooved director into the nostril, for the purpose of making counter-pressure, while pressure is applied in the opposite direction with the end of the finger. When there is a wound, denuding the bone, the diagnosis will seldom be difficult.

More or less *bleeding* generally attends this accident; occasionally,

indeed, it is quite profuse, and in one instance it is said to have proved fatal. Another symptom which is sometimes present, is emphysema at the root of the nose, extending along the eyebrows. It usually comes on within a short time after the accident, and is owing to an escape of air from the nostril across a rent of the mucous membrane into the subcutaneous cellular tissue. It is in itself of no moment, as it usually disappears spontaneously in a few days. Sometimes violent head symptoms attend these fractures, depending upon the intimate connection between the nasal and frontal bones, which permits the jarring effects of the blow or fall to be communicated to the brain and its envelops.

Fracture of the nasal bones is not always free from *danger*, although, in general, it is so, the patient recovering without any untoward symptoms. Real danger to life is to be apprehended only when there is serious cerebral involvement, as when the lesion is associated with fracture of the cribriform plate of the ethmoid bone, separation of the dura mater at the anterior part of the base of the skull, copious effusion of blood, or severe concussion of the brain. Under such circumstances, the patient may die from shock, from compression, or from inflammation. The prognosis should, therefore, be guarded, especially as the degree of danger cannot always be estimated by the amount of visible injury. If the fracture is multiple, or the bones are crushed in, more or less deformity may be expected after the cure.

The *reduction* is generally easy. The patient being seated upon a chair, with his head resting against the breast of an assistant, any depression that may exist is to be remedied by means of a female catheter or grooved director, inserted into the nostril, and made to bear against the displaced fragment until it has resumed its proper level. Sometimes a good deal of pressure and counter-pressure will be necessary, while at other times hardly any manipulation whatever will be required, the mere passage of the finger over the seat of the fracture being sufficient to adjust the fragments. When the nasal septum, or the perpendicular plate of the ethmoid, is thrown out of place, restoration may be effected by means of the finger, or some suitable instrument, introduced into the nostril.

When the fragments have been restored to their natural level, they will usually retain their position with little or no difficulty. Sometimes, however, they have a tendency to cave in, or to fall asunder, in spite of everything that can be done to counteract it. The best remedy is a stout adhesive strip, carried across the bridge of the nose from one cheek to the other; the plaster promptly adheres to the skin, and assuming the shape of the nose, effectually prevents further displacement. The older surgeons were in the habit of counteracting this occurrence by stuffing the nostrils with dossils of lint, smeared with ointment, and frequently changed for the sake of cleanliness. Subsequently, metallic tubes were recommended, and in modern times tubes of gum elastic have been used. All such contrivances are now very properly dispensed with; or, if they are ever employed, it is in cases where it is impossible, in consequence of the manner in which the

bones have been crushed, to remedy the displacement in any other way.

The symptoms which usually follow this accident, such as inflammation of the pituitary membrane, and swelling of the nose and face, are combated by general and local bleeding, purgatives, and other antiphlogistics. The brain is carefully watched, and any untoward symptom met at the earliest possible moment. Hemorrhage is restrained by cold applications, and elevation of the head and arms; if obstinate, by plugging up the nostrils.

#### FRACTURES OF THE UPPER JAW.

A fracture of the upper jaw implies the application of direct mechanical injury, in a concentrated and severe form. No ordinary force could produce such a result. In a few instances it has been caused by *contre-coup*, the head and lower jaw being wedged in between two hard, resisting bodies. Portions of the alveolar process, of variable shape, and even of large size, are sometimes broken off in the operation of extracting teeth. There is nothing definite at all in regard to the situation of the fracture, since it may affect any portion of the bone, its body, ascending process, horizontal plate, or alveolar process. It is always accompanied by severe injury of the soft and hard parts, and is usually of easy recognition, simple inspection, or touch, commonly sufficing for the purpose. The accident is apt to be followed by violent inflammation, requiring prompt measures for its relief.

In the *reduction*, pressure and counter-pressure are chiefly relied upon, the parts being moulded gently into their natural position by the fingers, either alone, or aided, as in fracture of the horizontal plate of the bone, by the grooved director inserted in the nostril. If the alveolar process has suffered, it may become necessary to secure its proper maintenance by tying together several of the contiguous teeth by thin silver wire. Whatever may be the nature of the case, the rule is, if possible, to save all, and take away nothing.

#### FRACTURES OF THE MALAR BONE.

Fracture of the malar bone is so very rare as to require merely a passing notice. Like fracture of the upper jaw, it is always produced by direct violence, is invariably attended with severe contusion, if not with other injury, of the soft parts, is, in general, readily recognized, is liable to be followed by high inflammation, and is easy or difficult of management according as there is displacement or no displacement. When the broken part has sunk down beyond its natural level, an attempt may be made to raise it, especially if there be already a wound denuding the bone, and admitting of the insertion of a suitable lever; if not, an incision is made, provided it seem probable that there will be unsightly deformity after the cure is effected, if the fragment be left in its abnormal situation. Such a procedure, although condemned by some high authorities, is much better, it appears to me,

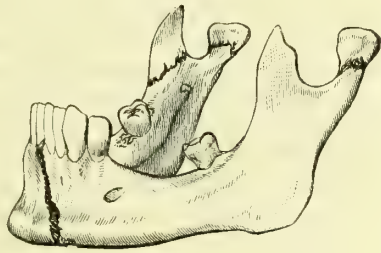


than to leave the bone where it was thrown by the accident. Fracture of the zygomatic process of the temporal bone, also exceedingly rare, is treated upon similar principles to that just described.

## FRACTURES OF THE LOWER JAW.

Experience has proved that the lower jaw-bone may be broken in any portion of its extent, even at the symphysis. Fracture here, however, is uncommon, and is met with chiefly in young subjects, before the complete union of the two opposite halves of the bone. The most common site of fracture is the body of the maxilla, towards its anterior extremity (fig. 56); and next in point of frequency, at least according to my observation, is its ascending ramus. The condyle, neck, and coronoid process are seldom broken. The fracture may be transverse, oblique, or longitudinal; single or multiple; simple or complicated. When the bone yields at two points, there will necessarily be three fragments; cases occur in which the number is still greater, the bone being literally crushed. Houzelot has published the particulars of one

Fig. 56.



in which the bone was broken at both condyles, through both coronoid processes, and at the symphysis, the accident having happened by a fall from a height. Sometimes the lesion is limited to the alveolar process, or this process gives way along with the body of the jaw. In either event, there will be involvement of the gums and teeth, with, perhaps, extensive separation of the latter, or even complete evulsion. Occasionally, though this is uncommon, a longitudinal fracture of the body of the bone is intersected at each extremity by a transverse or oblique one. The accident, which rarely occurs before the age of manhood, is much more frequent in males than in females.

The most common *cause* of fracture of the inferior jaw is direct violence, as a fall, blow, or kick. I have seen not less than four instances where it was produced by a blow with the fist upon the chin or side of the bone, one of the cases being a healthy lad between fifteen and sixteen years of age; the others, persons between twenty-five and thirty-two. A very common cause of this fracture is the kick of a horse. Dentists often break off portions of the alveolar process in their efforts to extract teeth. Sometimes frightful injury is produced in this way. Muscular action is capable of breaking the lower jaw. An old man, aged upwards of seventy, an out-patient of the College Clinic, presented himself to Professor Pancoast in January, 1857, on account of a fracture of the neck of this bone, caused the night before in a violent paroxysm of coughing. The symptoms were unmistakable. The explosion of powder in firing off a pistol within the mouth has also been known to give rise to the accident. Finally,

the jaw-bone is sometimes broken on one side by a blow upon the opposite, or by counter stroke.

The *symptoms* denotive of fracture of the body of the lower jaw are generally so well defined as to render it easy to form a correct diagnosis. Crepitation can almost always be observed in moving the fragments, and upon looking into the mouth the teeth will usually be found to have lost their natural relations. There is also commonly a perceptible inequality at the inferior border of the bone, which may always be increased by motion, and which is of itself sufficient to point out the character of the injury. When the jaw has given way on each side, the central piece will be drawn downwards by the action of the muscles of the throat, the front teeth will be out of their normal position, and the mouth will be open and distorted.

When the *ramus* of the jaw is broken, there will be a grating noise at the site of fracture, and excessive pain near the ear. From the fact that the masseter muscle is attached to and covers in both fragments, it is seldom, if ever, that there is any considerable displacement.

A fracture of the *neck* of the bone is easily detected, unless the subject is very fat, by the crepitation produced on moving the jaw, by the preternatural mobility in front of the ear, and by the manner in which the body of the bone is dragged forward by the action of the external pterygoid muscle. Similar symptoms will characterize fracture of the condyle of the bone.

In addition to the symptoms now described as characterizing fracture of different portions of the inferior maxilla, there will be more or less impediment in speaking and swallowing, difficulty in closing the mouth, and inability to masticate. The patient experiences severe pain at the seat of fracture, which is aggravated by motion and manipulation. The soft parts are usually considerably contused, if not also lacerated, and there is often smart hemorrhage, either from wound of the mucous membrane or rupture of the inferior dental artery.

Simple fractures of this bone usually get well in from four to five weeks, without any deformity or functional impediment. Those of the neck require a longer time, and more care in their management, than those of the body and ramus. Complicated fractures, on the contrary, are often followed by severe suffering, caused either directly by the resulting inflammation, or by some of its more serious consequences, as abscess, caries, and necrosis. I have known, more than once, a patient to become much emaciated from his inability to take appropriate nourishment during the long confinement of his jaw.

During the *reduction* of fractures of this bone, the patient should be seated upon a chair, his head being supported upon the breast of an assistant, and firmly held. The surgeon, passing his fingers along the base of the jaw, supposing that it is the body that is broken, moulds the parts into a proper shape, and then, closing the mouth, sees that the lower teeth rest fairly against the upper. When the fragments overlap each other, they must be drawn in opposite directions, when the slightest pressure will generally suffice to effect their reduction. If any of the teeth are loosened, or partially forced from their sockets, and they are perfectly sound in other respects,

they should by all means be retained, being secured, if need be, to the adjacent ones, by a strong ligature, or a thin silver wire. It was formerly the custom to treat such teeth as extraneous bodies, it being believed that they were incapable of re-adhesion; but more enlarged observation has shown the fallacy of this opinion, and the practice would, therefore, be highly reprehensible.

The fracture being reduced, as may always be known by the evenness of the dental arch and of the inferior margin of the jaw, a piece of pasteboard, or, what is preferable, of felt, is wet with hot water, and accurately adapted to the base and sides of the jaw, so as to form a firm mould for it. This being lined with wadding, and covered with a light compress, long enough to extend from the angles of the jaw nearly to the chin, is now confined by a roller carried round the top of the head in the form of the figure 8, one portion of the bandage lying in front of the ears, and the other behind them. The lower jaw being thus pressed firmly against the upper, the bandage is next conducted across the chin and the occiput above the ears, so as to give the fragments proper support in front. This mode of dressing, which is as simple as it is excellent, I have employed for many years, and give it a decided preference over every other of which I have any knowledge. If there be any unusual tendency to anterior displacement, it may be effectually counteracted by a stout adhesive strip, extending from the chin along the lower part of the face to the side of the occiput.

The annexed cuts (figs. 57 and 58) represent the bandages of Gibson and Barton, so much employed in this country. Their mode of application will readily be perceived by an examination of the drawings.

Fig. 57.



Gibson's jaw bandage.

Fig. 58.



Barton's jaw bandage.

When there is no displacement of the fracture, as sometimes, though rarely, happens, an equally simple, but less efficient, contrivance will answer the purpose, as a pasteboard mould and a four-tailed bandage. The centre of the bandage being applied to the chin, the posterior tails are pinned to the front, and the anterior to the back of the patient's night-cap.



It was formerly customary, in bandaging fractures of the lower jaw, to fill up any irregularities that might exist between the two rows of teeth by the interposition of pieces of cork; but the practice, if I mistake not, is no longer pursued by the scientific surgeon; and yet it is easy to conceive of a case where, in consequence of the loss of all the incisor, cuspid, and bicuspid teeth, and the retention of some of the molar, some artificial support might become necessary for the proper maintenance of the fragments. In such a case the services of a skilful dentist should be called into requisition.

In fracture of the neck or condyle of the jaw, the maintenance of the reduction is always peculiarly difficult, on account of the action of the external pterygoid muscle. The most effective means of counteracting this disposition is to confine a thick, graduated compress behind the angle of the bone, the treatment being in other respects the same as in fracture of the body of the jaw.

When the fracture is comminuted, it will sometimes be found exceedingly difficult, if not impossible, despite our best directed efforts, to keep the fragments on a level with each other, such being their constant tendency to displacement. To rectify this tendency, it may be necessary to connect the contiguous teeth of the adjoining pieces with delicate silver wire; or, what is better, because more efficient, some of the teeth may be secured to a thin silver plate, interposed between them and the cheeks.

Wounds, contusions, and hemorrhage, complicating these fractures, are managed upon general principles; inflammation is combated by the usual antiphlogistics; loosened teeth and necrosed pieces of bone are removed as soon as they are detached; and the parts are kept steadily at rest, renewal of displacement being guarded against by the most sedulous attention both of the patient and the surgeon. The food should consist of slops, as grated cracker and milk, broths, gruel, and similar articles, and should be introduced into the mouth with a small spoon. The custom which formerly prevailed of conveying nourishment into the stomach by means of a tube carried along the nose, has become obsolete, as well as the still more reprehensible practice of extracting one of the front teeth, to afford room for feeding the patient. After the case has advanced for several weeks, a semi-solid, farinaceous diet may be allowed.

#### FRACTURES OF THE HYOID BONE.

Fracture of the hyoid bone is extremely rare. The cause of this immunity is to be found in the great mobility of this bone, and in the protection which it receives from the lower jaw. The accident is usually occasioned by falls or blows, or by the pressure of the thumb and fingers in attempts at choking. An instance is mentioned where it was produced by muscular action, the patient having fallen violently backwards upon his head. Persons who commit suicide by hanging occasionally break this bone with the rope. The fracture is generally seated in the large horns of the bone, sometimes in both, at other times only in one. It is liable to be complicated with injury of the larynx,

lower jaw, and other parts, the skin being usually bruised and discolored. The patient is unable to swallow, to articulate distinctly, and to move his tongue, except in the most limited degree, and then not without great suffering, and, perhaps, a sense of suffocation. Crepitation is generally sufficiently evident, especially during deglutition and when the index finger is placed in the throat in contact with the smaller fragments, the corresponding finger resting upon the neck. The pain is very acute, and is aggravated by the slightest motion. Sometimes the patient is conscious of a peculiar crushing sound at the moment of the accident. Occasionally there is laceration of the mucous membrane of the fauces, followed by pretty copious hemorrhage, as in the interesting case reported by Professor Wood, of Cincinnati.

Fracture of the hyoid bone, although not dangerous to life, is generally exceedingly troublesome on account of the great mobility of the fragments, and the tendency in the supervening inflammation to be followed by severe swelling; occasionally abscesses form, the detached piece becomes necrosed, and the neck is pierced with fistulous orifices, which are slow in healing. The accident has hitherto been noticed chiefly in aged subjects, probably, on account of the great brittleness of the bone at this period of life.

In the *treatment* of this fracture, attention must be paid to the position of the head, which should be inclined forward, and maintained in a state of the utmost quietude, by an appropriate bandage secured around the chest. If there be much pain and swelling, leeches should be applied to the neck, followed by saturnine and anodyne fomentations; the bowels should be freely evacuated by stimulating injections, and fever should be combated, if it exist, by copious bleeding at the arm. For the first few days, the patient should abstain as much as possible from food and drink, taking, at all events, no more than what is just sufficient to sustain life. If he cannot swallow, a stomach tube must be used, but, in general, this will not be necessary. After the swelling of the neck has measurably subsided, an attempt should be made to keep the fragments in place by a compress and adhesive strips, though little, it must be confessed, is to be expected from such a course. If any portion of the bone becomes necrosed, an early opportunity is sought to extract it. In ordinary cases, the fracture will unite in from six to eight weeks.

#### FRACTURES OF THE CLAVICLE.

The clavicle, owing to the delicacy of its structure, its exposed situation at the top of the chest, and its connection with the shoulder and arm, is extremely liable to break. Of 2358 cases of fractures of different pieces of the skeleton, referred to by Malgaigne, 228 occurred in this bone, and of this number nearly three-fourths were observed in the male, thus showing a remarkable disparity in regard to the relative frequency of the lesion in the two sexes. The accident is not peculiar to any particular period of life; I have witnessed it in a child under six months of age; and Dr. W. Keller, of this city, showed me a case last winter in which it took place in the foetus in

the womb, in consequence of a fall of the mother upon the wheel of a carriage, at the eighteenth week of gestation. The child, at the time of my examination, was several months old, and the seat of the fracture, which had involved the right clavicle, near its middle, was indicated by a marked forward angular projection of the ends of the fragments, which, however, were firmly united, the consolidation having been completed before birth.

Fractures of this bone may be simple, compound, or comminuted; unilateral or bilateral; transverse or oblique. A transverse fracture of the clavicle is among the rarest of accidents; as for myself, I have never met with an instance of it, either in the living subject, or in any of the specimens in our museums. The bone nearly always gives way obliquely, the ends of the fragments being generally rather long and sharp, and often distinctly serrated. When very sharp, they sometimes project through the skin, or, at all events, press against it with so much force as to cause severe uneasiness, and great difficulty in maintaining apposition. It is very uncommon for the bone to break at several points; such an accident, in fact, can only happen from the application of direct force. Simultaneous fracture of both clavicles has been observed only in a few instances. I have two clavicles in my possession, from the same subject, which were both broken at the same point, but whether at the same time, I am unable to say.

The *seat* of fracture is usually at or near the middle of the bone, where it is thinnest and weakest. Of twelve preparations now before me, it is in eight about this point; in three it is towards the acromial extremity, and in one towards the sternal. Fracture of either end is, I suppose, very uncommon, as I have never met with an instance, either during life or after death.

Great *displacement* generally attends fractures of the clavicle (fig. 59);

Fig. 59.



now and then, however, we see cases where the broken ends maintain their natural relations, as I have myself noticed in two instances. Such an event can only occur when the fracture is incomplete, as sometimes happens in children, or when the periosteum is only partially divided, and the patient has taken care not to permit any dragging of the shoulder. As a general rule, the outer fragment will be found to be drawn downwards, forwards and inwards, by the weight of the limb and by the action of the deltoid, small pectoral, and subclavian muscles; the inner, on the contrary, is usually somewhat raised by the sternocleido-mastoid, but not nearly as much so as its extraordinary prominence would seem to indicate, its tendency to displacement in that direction being pretty effectually counteracted by the great pectoral



muscle and the costo-clavicular ligament. In fracture of the extremities of the clavicle, the loss of apposition is usually very slight, its occurrence being prevented by the manner in which the bone is attached to the scapula and the sternum. In comminuted fracture, the displacement is sometimes so great as to render reposition impracticable, the middle fragment being occasionally tilted perpendicularly up.

The accident is generally *caused* by indirect violence, as a fall upon the shoulder, in which the sternal extremity of the bone is impelled by the weight of the body, at the same time that the acromial end is thrust forcibly in the opposite direction by the object struck against. Not unfrequently, however, it occurs from direct injury, as a blow or fall. In one instance I knew it to be produced by the kick of a gun, in shooting at a flock of pigeons. Children often break their collar bones by tumbling out of bed, or rolling down a flight of stairs. When both clavicles are broken, one generally gives way by indirect, and the other, immediately after, by direct force.

The *symptoms* of fracture of the clavicle are generally well marked. The shoulder has a singularly sunken appearance, being drawn downwards, forwards, and inwards by the weight of the limb and the action of the muscles, especially the deltoid and small pectoral; the head and trunk are inclined towards the injured side; there is impossibility of rotating the arm, or of carrying the hand to the face; and the patient commonly supports the elbow in order to take off the weight of the limb from the broken bone. Upon examination, the seat of the fracture is generally readily discovered by the eye, the deformity being nearly always extremely conspicuous; and the finger, as it traces the outline of the bone, cannot fail to detect any existing irregularity. Crepitation is elicited by taking hold of the elbow and pushing the arm upwards, outwards, and backwards, in a direction opposite to that of the displacement. The same procedure will serve to efface the deformity, which, however, will be instantly reproduced upon the removal of the restraint. When the fracture is imperfect, or unattended with displacement, the diagnosis can only be established, as a general rule, by a careful digital examination, aided by the alternate elevation and depression of the shoulder.

Although, in general, the patient is unable, in fracture of the clavicle, to carry his hand to the head, yet I have met with some very striking exceptions to this rule, both in children and adults. In a man, aged forty, whom I saw a few years ago with Dr. Denis O'Reilly, the patient could execute this movement with quite as much facility as with the other limb. He could even swing it about without any pain or inconvenience. The fracture, caused by a fall on the edge of a doorstep, was situated towards the acromial extremity of the bone, and was attended with marked displacement. Children, according to my observation, are more subject to this anomaly than grown persons.

My experience is that fractures of the clavicle are seldom cured without more or less deformity, whatever pains may be taken to accomplish the object. In some of my cases I have found it impossible, despite all the efforts I could command, to effect accurate restoration of the ends of the fragments. This difficulty will, I think, be most

likely to occur when the fracture is seated at or towards the acromial extremity of the bone, in which event the outer fragment is frequently, if not generally, thrown backwards in such a manner as to render it almost impossible to bring it to its natural position. From the cases that I have seen of this fracture, as treated by other surgeons, and from the numerous specimens of it to be found in our museums, I am satisfied that a cure without deformity is a very uncommon result. It is gratifying, however, to know that deformity, even when considerable, does not, as a general rule, at all impair the usefulness of the limb. Union will, of course, be materially retarded, but in time nature will succeed in rounding off the ends of the fragments, and in connecting them firmly together, either by an osseous clasp or a kind of bridge. When union fails to occur, the power of the arm is always weakened. In ordinary cases, consolidation takes place, in the adult, in about five weeks, and in children, in eighteen or twenty days.

In the *reduction* of fracture of the clavicle, all that is generally necessary is to take hold of the elbow and to carry the arm upwards, outwards, and backwards, a procedure which rarely fails to effect approximation of the ends of the fragments. If anything more is required, the fingers may be passed along the broken bone, so as to assist in moulding the parts into proper shape. During the treatment the indication is to maintain the shoulder in the position here adverted to; and for this purpose it will be necessary to support the limb in such a manner as to bring the elbow against the antero-lateral aspect of the chest, while the forearm rests against the front, the fingers lying across the opposite clavicle. To confine them in this position, the best dressing is a number of adhesive strips, of appropriate length, to reach around the limb and shoulders, so as to form, in the first place, a kind of immovable sling, and secondly, to secure the arm to the side of the trunk. When this dressing, which is more easily applied than described, is carefully put on, it answers the object much better than any of the numerous contrivances that have ever been invented for the cure of this fracture. The strips, which should be from an inch and a half to two inches in width, may be so arranged as to make a certain degree of pressure, through the medium of a compress, directly upon the seat of the fracture, or, if this be deemed unnecessary, the seat of fracture may be kept under constant surveillance by letting it remain uncovered. The dressing, if properly applied, need not be renewed oftener than once or twice during the treatment, if, indeed, at all. If the patient be an adult, and the skin be covered with hair, the surface should be previously shaved. When there is a tendency on the part of the shoulder to sink forwards and inwards, it should be counteracted by a wedge-shaped pad in the axilla, the large extremity being directed upwards, and confined by suitable tapes to the opposite shoulder. In general, however, I have not found it necessary to resort to such an expedient.

Next to the adhesive strip-dressing, which I have used and recommended for some years past, in the treatment of fractured clavicle, I prefer a very simple contrivance, somewhat after that of Velpeau. It consists of a wedge-shaped pad, and an ordinary roller, carried round the limb, shoulder, and trunk, so as to confine the parts in the

position already indicated. The different turns of the bandage should be secured to each other by a large number of pins, which thus serve to keep them effectually in place. I seldom use less than from thirty to forty, and I find that, when this is done, the bandage may be worn with great advantage for several successive weeks, without the slightest derangement. In warm weather, however, it should be removed at least as often as every ten days for the sake of cleanliness, especially if the patient perspire much.

An ingenious apparatus for the treatment of fracture of the clavicle has been devised by Dr. R. J. Levis, of this city, which, combining most of the principles of that of Dr. Fox, so long and so extensively used in this country, commends itself by its simplicity, lightness, efficacy, and cheapness. It consists of a short, firm, axillary pad, supported by two straps which are buckled to a broad supporting band. From the front of this band, which crosses the upper part of the back, and descends on the anterior portion of the chest, giving a firm surface of support, is suspended a sling in which the elbow is sustained. On the back of the sling, behind the elbow, is fastened a strap which crosses the back obliquely, and coming in front on the sound side, is buckled to the front end of the supporting band.

In adjusting the apparatus, the pad is first placed in the axilla by passing the arm through the opening between the straps above the pad. The wide band is then thrown across the shoulders, the elbow placed in the sling, and the long strap attached to the back of the sling carried across the back and finally buckled at its front attachment to the wide supporting band.

In removing the apparatus from the patient, it is only requisite to loosen the front attachment of the latter strap, which will allow the sling to drop from the elbow.

Fig. 60.

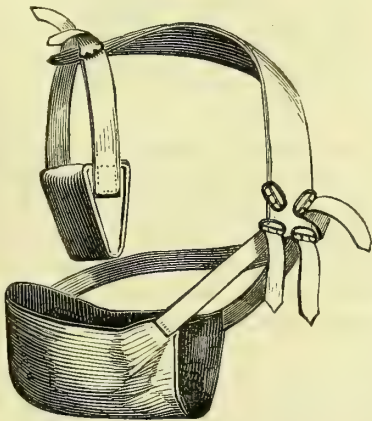


Fig. 61.





The extra buckle, which is noticed at the front end of the wide supporting band, comes into use when the apparatus is reversed for the opposite shoulder.

The apparatus of Dr. Levis may be made of any strong material, as drilling, webbing, or soft leather, and its different pieces may be attached together with buckles, or, if more convenient, with buttons, or tapes. Fig. 60 exhibits the various parts of the apparatus, and fig. 61 a front view of its application.

The French surgeons were formerly much in the habit of using the stellate, or figure of 8 bandage, represented in fig. 62. It consists of a wedge-shaped pad and a long roller, carried alternately round each shoulder, after which the arm and forearm are secured to the side and front of the chest in the usual manner. The bandage of Desault, once so much employed in this country, has fallen into deserved neglect. Boyer's apparatus for fracture of the clavicle is represented in fig. 63.

Fig. 62.

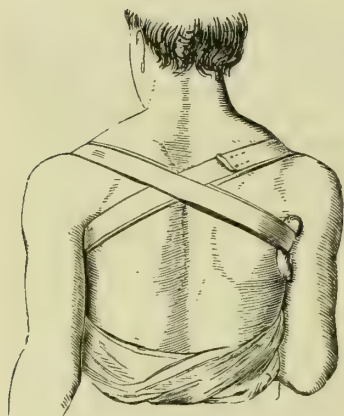
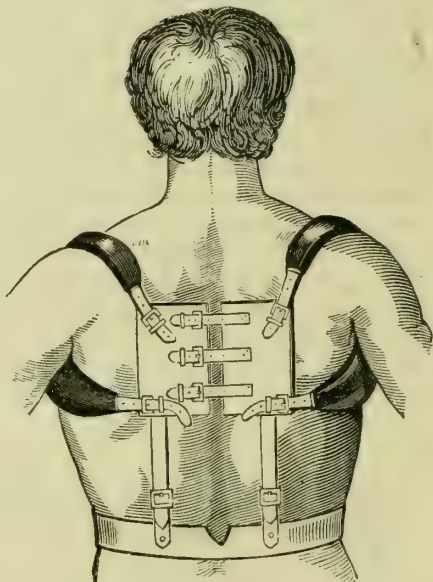


Fig. 63.



Dr. Dugas, of Georgia, is in the habit of treating fractures of this bone with a pad and a triangular piece of thick, unbleached muslin, to each angle of which is attached a bandage from three to four yards in length by three inches in width. The apparatus, which is described at length in the Southern Medical and Surgical Journal for 1852, is applied in such a manner as to form a sling for the elbow and forearm, at the same time that the arm is firmly secured to the side.

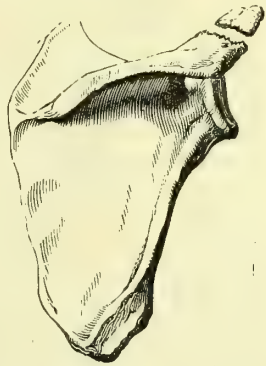
#### FRACTURES OF THE SCAPULA.

Fractures of the scapula are extremely uncommon. Of 1,902 cases of fractures of different pieces of the skeleton, treated at the Middlesex

Hospital, London, only 18, according to Lonsdale, occurred in the shoulder-blade. At the Hôtel-Dieu, at Paris, the scapula, in 2,358 cases, was broken only in 4. On the contrary, a remarkable disproportion of such cases sometimes occurs in the hands of particular surgeons. Thus, Dr. Dugas has met with four cases of this accident; and Dr. Bulloch, of Savannah, with not less than six, although neither has seen a great many fractures of other bones. The injury may show itself in various forms and directions, and may occupy either of the two processes of the scapula, its neck, or its body.

a. The *acromion process* (fig. 64) being the most exposed portion of the scapula, is more frequently broken than any other part of this bone, the accident being usually caused by a blow upon the top of the shoulder, or by violence applied directly to the process itself. It may also be produced by force transmitted along the humerus by a fall upon the elbow or palm of the hand. The fracture is generally somewhat oblique, and its signs are so peculiar as to be characteristic. The natural rotundity of the shoulder is destroyed; the outer fragment is drawn down by the weight of the arm, which hangs motionless by the side of the body; the head of the humerus can be felt in the axilla; there is a depression at the situation of the fracture; the distance between the shoulder and the top of the sternum is diminished; and a distinct crepitus may be detected on pushing up the arm in contact with the displaced fragment. In addition to these symptoms there is acute pain at the seat of the injury; the limb cannot be raised by its own efforts; and the patient inclines his head towards the affected side, and supports the forearm as in fracture of the clavicle.

Fig. 64.



Fracture of the acromion process is distinguished from dislocation of the humerus into the axilla by the circumstance that, in the former, the limb is movable, but fixed in the latter; that the signs of the accident are easily effaced by elevating the arm, but immediately recur when the surgeon lets go his hold, whereas, in dislocation, the reduction always requires a certain degree of force, and does not relapse when it has been effected; in the former, moreover, there is usually crepitus, but not in the latter. In tracing the spine of the scapula, the finger, as it approaches the acromion process, will sink down if there be fracture, whereas it will be unusually prominent if there be dislocation.

The *union* is usually ligamentous instead of osseous, owing to the difficulty which is experienced in preserving the contact of the fragments. This occurrence will be more likely to happen when the tip of the acromion is broken off than when the fracture is seated near its root.

The leading indications in the *treatment* of this lesion are, first, to secure the arm and forearm firmly to the antero-lateral part of the

chest; and, secondly, to raise the humerus against the top of the shoulder-joint, so that its head shall serve as a splint for the broken process. For this purpose, the same bandage is used as for fracture of the clavicle, but the axillary pad is dispensed with, lest the broken piece should be pushed too far outwards.

*b.* In fracture of the *neck* of the scapula, the coracoid process and glenoid cavity are detached from the rest of the bone in an oblique direction. The accident is one of great rarity, so much so that many surgeons have doubted the possibility of its occurrence. It can be produced only by great direct violence, though one case is known where it was caused by muscular contraction in a young lady, in the act of throwing her necklace over her shoulder, the bone having doubtless been exceedingly brittle from some organic defect. The symptoms are always well marked. The acromion is unusually prominent, the head of the humerus is felt in the axilla, the shoulder has a flattened appearance, the limb is lengthened, the coracoid process is thrown down below the clavicle, between the deltoid and pectoral muscles, severe pain and numbness are experienced in the axilla, and a distinct crepitus is perceived on rotating the arm upon the scapula. The accident bears, at first sight, considerable resemblance to dislocation of the humerus into the axilla; but from this it is always readily distinguished by the facility with which the parts may be restored to their natural situation, by the immediate return of the symptoms when the limb is left to itself, and by the existence of crepitus. From fracture of the neck of the humerus it may be known by the circumstance that, in the latter, the shoulder retains its rotundity, and that the limb, instead of being lengthened, is shortened; the acromion also is much less prominent.

In two cases of this accident, observed by Dr. Dugas, the fracture, produced by a blow upon the shoulder from a falling tree, was instantly followed by paralysis of the limb and cessation of pulsation in all its arterial trunks; a consequence, evidently, of injury done to the axillary vessels and nerves. Treatment having been neglected, no union took place, and the arms have never regained their functions.

This fracture is retained with difficulty, and is liable to be followed by stiffness of the shoulder-joint, atrophy and paralysis of the muscles of the arm, and other disagreeable symptoms. It is managed in the same manner as fracture of the clavicle, a pad being placed in the axilla, the elbow being kept well raised, and the scapula thoroughly steadied until reunion has occurred. If the parts are much contused, leeches, fomentations, and other antiphlogistics may be required. Passive motion should be instituted at the end of three weeks, and renewed every few days afterwards. Consolidation may be expected in two months.

It is not improbable that the edges of the glenoid cavity may occasionally be broken off, either by direct force, or in consequence of the sudden and violent propulsion of the head of the humerus. It is remarkable, however, that the existence of such a lesion has never been demonstrated by dissection. Is it not likely that some of the bad forms of luxation of the shoulder-joint, in which the reduction is maintained



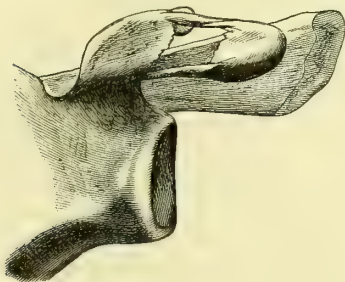
with great difficulty, and which are so liable to terminate in permanent ankylosis and ruin of the articulation, are cases of this description? The subject is worthy of greater attention than it has hitherto received. In the annexed cut (fig. 65), copied from Mr. Fergusson, the fracture extends through the glenoid cavity.

c. The *coracoid process* is sometimes broken in

Fig. 65.



Fig. 66.



Fracture of the coracoid process.

consequence of a severe fall or blow, generally a short distance from its tip, the fracture being usually accompanied with evident contusion of the soft parts, and similar lesion of the acromion, clavicle, or humerus. The accident, which is of very rare occurrence, is characterized by inability to raise and adduct the arm, by preternatural mobility, by depression of the detached fragment by the conjoined action of the small pectoral, two-headed flexor, and coraco-brachial muscles, and by the detection of crepitus on moving the arm upon the shoulder, the finger being placed between the deltoid and great pectoral muscles. The adjoining sketch (fig. 66), taken from a preparation in Professor Neill's collection, affords an illustration of a well marked specimen of fracture of the coracoid process.

The treatment consists in confining the arm and forearm to the anterior part of the chest by means of a bandage and sling, care being taken to keep the elbow well raised, so as to fix the top of the scapula, and support the broken part. By this procedure, the pectoral and flexor muscles of the arm are relaxed, and prevented from acting injuriously upon the tip of the coracoid process.

Violent inflammation, occasionally terminating in profuse suppuration, and even in death, is apt to follow this accident, owing to injury inflicted upon the pectoral muscles and the axillary vessels, nerves, and glands. The matter being deep seated, has great difficulty in reaching the surface, and is, therefore, disposed to burrow extensively among the surrounding structures. The proper remedy is an early and free incision at the most dependent portion of the abscess.

d. The *body* (fig. 67) of this bone rarely suffers from fracture, and then only from great direct violence, causing at the same time serious injury in the soft parts. In one case, recorded by a foreign writer, the accident is said to have been produced by muscular action. The frac-

Fig. 67.



The ordinary situation of fracture of the body of the scapula.

ture exhibits no regularity in regard to shape, is often multiple, and is rarely attended with displacement.

To steady the shoulder-blade, which is the leading indication in the treatment of this accident, two large, narrow, and moderately thick compresses should be placed along its axillary and vertebral borders, and confined by a broad roller carried round the upper part of the trunk; or, instead of this, they may be secured by means of large adhesive strips. The arm and forearm are then fastened to the anterior part of the chest, as in fracture of the clavicle.

e. Fracture of the *inferior angle* of this bone is occasionally met with; it is marked by preternatural mobility, by displacement of the smaller fragment by the action of the great serrated muscle, and by acute pain at the seat of the injury. The diagnosis may readily be established by fixing the top of the scapula and moving the lower angle; if they follow each other, it will be an evidence that there is no fracture, and conversely. The treatment is the same as in fracture of the body of the bone.

#### FRACTURES OF THE RIBS.

The central ribs, from their exposed and fixed position, are much more liable to be broken than the upper and lower; the former being safely protected by the collar-bone, the scapula, and numerous thick and strong muscles, while the latter, from their great shortness and mobility, can readily glide out of the way of any injury that might otherwise affect their integrity. However this may be, they usually yield at their more prominent points, in an oblique direction, a transverse fracture being here, as elsewhere, an unusual occurrence. The accident is most frequent in elderly subjects, children and young persons seldom suffering. The causes are twofold, external violence and inordinate muscular action. The first produce their effect either in a direct or indirect manner; most commonly in the former, as when the ribs are struck by a fall or blow, or when the body is traversed by the wheel of a carriage. In the second case, the ribs, being impelled by forces operating upon their extremities, break at or near their middle, as when, for example, the back of the chest is pressed against a wall by a railroad car. When these pieces are acted upon directly, their curvature is diminished; but increased when the violence is applied indirectly. A rib has occasionally been broken by mere muscular contraction in the act of coughing, but such an occurrence is unusual, and implies an abnormal condition of the osseous tissue.

The number of ribs broken at any one time is variable. The largest number that I have ever met with was eight; sometimes, however, it is still greater. The fracture may occur simultaneously upon both

sides; and it may be either simple, or complicated with other injury, as rupture of the intercostal artery, wound of the soft parts, and laceration of the pleura and lung.

A fracture of the more superficial ribs is often easily detected simply by placing the hand upon the part where the violence is supposed to have been inflicted, and requesting the patient to cough. The bones being thus obliged to undergo a sudden motion, the lesion, if it exist, will be almost sure to show itself by the occurrence of crepitation and preternatural mobility. If, however, the fracture be placed under cover of a large quantity of muscular and fatty matter, as it will be in certain situations in robust and corpulent subjects, the surgeon may find it very difficult, if not impossible, to detect it. Should this happen to be the case, the examination should be repeated again and again, until the diagnosis is satisfactorily determined. The difficulty will be increased if only one rib be broken, or if the broken bone retain its normal position; on the other hand, the diagnosis may be established at a glance if the injury be extensive, and attended with marked displacement, as when it has been inflicted by a fall, or by the kick of a horse. Finally, the patient, as he takes a deep inspiration, is occasionally sensible of a peculiar cracking noise at the site of the fracture.

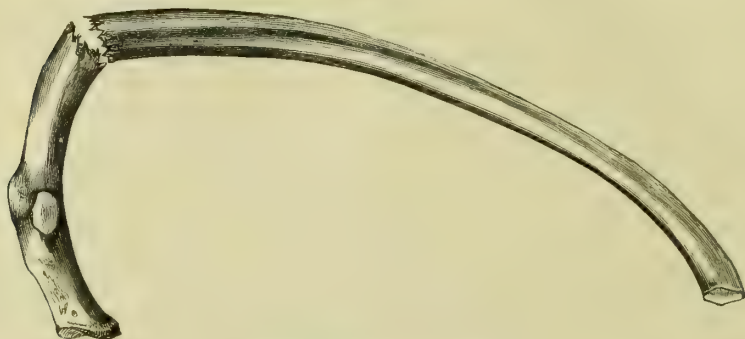
The pain which attends the fracture of a rib is generally very acute, and, without being strictly limited to the seat of the injury, is always more severe there than anywhere else; it is exasperated by the respiratory movements, and is commonly so violent as to compel the patient to breathe entirely with the aid of the diaphragm. Every attempt at a full inspiration, coughing, or sneezing, is followed by exquisite suffering. In very aggravated cases, the pain resembles that of pleurisy, and is accompanied with intense thoracic oppression. If the lung has been wounded by a spicule of bone, or the projecting end of the broken rib, there will probably be spitting of blood, if not hemoptysis, and, perhaps, also emphysema. In the latter case, the air may fill the cavity of the chest, causing a hollow sound on percussion, and total extinction of the respiratory murmur, attended with great increase of dyspnoea. Should the air escape into the subcutaneous cellular tissue, it will form a diffused tumor, soft and crackling, and at once indicative of the nature of the case. More or less copious hemorrhage will be present when there has been laceration of an intercostal artery, the blood sometimes passing into the chest, but more generally escaping externally.

The ribs being firmly connected to the costal cartilages in front, and to the vertebræ behind, it is impossible for them to undergo any shortening when they are fractured, or for the ends of the fragments to overlap each other, as in fracture of the long bones. Derangement, however, may take place in almost any other direction, although the angular is by far the most common, and this may be either outwards or inwards (figs. 68 and 69), according to the manner in which the injury was inflicted, the latter being usually produced by direct violence, the former by indirect. It is seldom, however, that more than one end of the bone is displaced in this direction at the same time.



The Mütter cabinet contains several specimens in which one of the fragments projects above the level of the others.

Fig. 68.



Angular displacement outwards.

Fig. 69.



Angular displacement inwards.

Fractures of the ribs are not always devoid of danger, even when they are perfectly simple, or apparently free from all complication. Their number may be so great as to cause severe shock, or such an amount of local and constitutional disturbance as to produce alarming illness and even death. The danger is generally greater, all other things being equal, in fracture of the upper ribs than in fracture of the middle and lower, because a greater degree of violence is generally required to produce it. A fracture complicated with injury of the lung and pleura must be looked upon as a serious occurrence, as it is sure to be followed by more or less inflammation, if not by hemorrhage and pneumothorax. An escape of air beneath the skin is a matter of no consequence, except as indicating serious lesion within the chest. Hemorrhage from a wound in an intercostal artery is usually rather troublesome than dangerous.

The following case, which fell under my observation in August, 1854, strikingly illustrates the danger of fracture involving a number of ribs, without any very serious complication.

Mrs. Hall, of Monmouth, Illinois, a tall, slender woman, aged fifty-

four, fell, while the railroad cars were in the act of running off the track, against the top of one of the seats, breaking eight of the ribs on the left side. The second, third, fourth and fifth bones were fractured in front, about two inches and a half from their cartilages, while the eighth, ninth, tenth and eleventh, had given way behind, within a short distance of the spine. There was no displacement of any of the fragments, excepting the posterior one of the tenth rib, which projected slightly inwards towards the chest, and pierced the pleura. Excessive pain, dyspnoea, crepitation, and preternatural mobility, marked the accident. The cough was violent, and the patient was unable to lie in bed. The ordinary treatment was pursued, but without any material benefit, and the woman died at the end of the fourth day, exhausted by her suffering. The left side of the chest contained about three ounces of coagulated blood, evidently furnished by the wounded pleura, but there was no sign of inflammation, except at the seat of the upper fracture, where the serous membrane was a little roughened by lymph and slightly ecchymosed. The lung was free from disease. The other organs were sound.

Fracture of the ribs, without complication or displacement, is best managed by encircling the chest with a broad bandage, drawn sufficiently tight to compel the patient to perform respiration chiefly by the diaphragm, the intercostal muscles, and consequently, also, the ribs being rendered perfectly passive. The bandage should be from eight to ten inches in width, and long enough to extend at least twice around the body. The ends being fastened by two pieces of tape, a scapulary is attached to prevent the cloth from slipping. Or, instead of this, the chest may be surrounded with broad strips of adhesive plaster, arranged so as to overlap each other partially, and drawn with sufficient firmness to keep it perfectly motionless. Female patients may wear, with great advantage, their usual corsets, a triangular piece being cut out in front and below to allow due play to the diaphragm. In addition to the bandage, I usually employ a thin, flat compress, as a small folded napkin, to give greater support to the broken bone.

Similar dressings will answer when there is outward displacement of the fragments, only that it may be necessary to employ a somewhat thicker compress; but how are we to proceed when the end of the broken bone is driven inwards towards the chest, perhaps into the pleuritic sac and the lung? Should it be let alone, or ought we to follow the practice of the older surgeons, and make an attempt to elevate it with the finger, the gimlet-screw, or the trephine? It is evident that counter-pressure by means of thick compresses applied to the extremities of the rib can be of no use. If there be a wound, it might be easy enough to insinuate a small lever, and raise the bone, if not to its proper level, at least out of harm's way. As for myself, I should certainly not meddle with the case, even if the depression were very considerable, unless the symptoms were most urgent, and not then until I had given a fair trial to other means, as the bandage and ordinary antiphlogistics, especially the lancet and full doses of anodynes. If relief did not soon follow, or if the suffering, instead of diminishing, rapidly increased, and it was perfectly obvious from the

violence of the pain, cough, and expectoration, that a piece of rib had been forced into the substance of the lung, I should then, I think, not hesitate to make an attempt to raise the offending fragment, or, failing in this, to remove it altogether. Cases requiring such heroic measures must be exceedingly rare, and hardly deserve formal mention in a work of this kind.

Wounds, contusions, and hemorrhage, consequent upon these accidents, must be treated upon general principles. If air collect within the chest in sufficient quantity to cause excessive respiratory embarrassment, it should be let out with a delicate trocar, introduced through a valve-like opening in the skin. Pain and cough are relieved in the usual manner. If the local distress be urgent, leeches may be used, followed by the application of a large opiate plaster. The patient observes the semi-erect posture in bed, and remains within doors until he feels that he can exercise with impunity. If his bandage become

insupportable, he must not lay it aside, but simply slacken it.

The annexed drawing (fig. 70), affords an illustration of the manner in which the ribs are sometimes tied together by bony matter after fracture. It was taken from a specimen in my collection.



Fig. 70.

Cases occasionally occur where the rational symptoms of fracture of the ribs exist, but in which the characteristic are absent. Under such circumstances, the rule is to treat the patient precisely as if the bones were really broken.

#### FRACTURES OF THE COSTAL CARTILAGES.

Fracture of the costal cartilages is so uncommon, that a long time elapsed before surgeons were willing to believe it a possible occurrence. That it does take place, however, is a fact fully established by modern observation; and, what is remarkable, experience has shown that it is not always necessary for these bodies to be ossified before they can be broken, although this is usually the case. The accident is invariably produced by external violence, either directly or indirectly applied, and is observed chiefly in elderly subjects. The fracture is usually single, and the pieces which are most liable to suffer are the fifth, sixth, and seventh, owing probably to their great length and to their exposed situation. The direction of the fracture is commonly somewhat oblique; the ends of the fragments often overlap each other, the posterior passing in front or behind the anterior, which, from its connection with the sternum, serves as the fixed point.

The same symptoms which serve to denote a fracture of the ribs will serve to point out one of the costal cartilages. The accident may



be simple or complicated, but, in general, it is comparatively free from danger. The broken ends are united through the intervention of a clasp or ferule of bone, in which the cartilaginous tissue remains unchanged. The reduction and maintenance of this fracture are often very difficult, but by a careful observance of the rules laid down in speaking of fracture of the ribs, the surgeon will usually succeed in effecting a cure in six or eight weeks. Malgaigne advises the use of a broad truss for keeping the fragments together, the pad making direct, but gentle pressure upon their extremities.

## FRACTURES OF THE STERNUM.

This bone may give way in almost any portion of its extent, but more commonly near its middle, the direction of the fracture being generally somewhat oblique. A few instances of longitudinal fracture of the sternum have been observed. Blows, kicks, and falls are the ordinary causes of the accident. Chaussier relates a case where it was occasioned by violent muscular contraction during labor, and several examples of a similar nature have been recorded by more recent observers. Last autumn, Dr. Rohrer, of Chestnut Street, had the kindness to show me a case, in a large, heavy, muscular man, aged forty-seven, who met with a transverse fracture of the upper part of this bone, from inordinate contraction of the sterno-cleido-mastoid muscles, in jumping, while intoxicated, from a shed eleven feet high upon the earth below. The heels striking the surface obliquely, threw the body violently backwards, the head and neck coming in contact with the edge of a board, which projected several inches above the pavement. The fracture no doubt occurred in consequence of the effort which the man made to regain his equilibrium.

The ends of the fragments either preserve their natural relations, or, if there be any displacement, it is in the direction of the thoracic cavity; in which case the broken bone may lacerate some of the contained viscera, cause effusion of blood into the anterior mediastinum, and perhaps induce emphysema by wounding the lungs.

When the fracture is attended with displacement, it may usually be detected at a glance, or by merely passing the finger over the line of injury. Grating, sometimes audible at a considerable distance, and increased at every respiratory effort, is generally present. The pain is excruciating; recumbency is, for a time at least, impracticable; and there is great dyspnoea, along with cough, spitting of blood, and other symptoms of internal injury.

In the case which I saw with Dr. Rohrer, there was, even several days after the accident, a marked depression at the site of fracture, with considerable irregularity of the ends of the fragments, which was much increased when the patient sat up in bed. During recumbency, when he coughed hard, the hand, placed over the seat of the injury, could distinctly feel the fragments ride over each other, the upper evidently moving more freely than the lower. It seemed as if their edges were beveled off obliquely, that of the lower piece from above downwards, and from before backwards, and that of the upper in the opposite direc-

tion. Two or three times, as the man coughed, a distinct grating noise was heard. Percussion upon the spine, immediately opposite the fracture, had also the effect of displacing the ends of the fragments, and a similar result followed when firm pressure was made upon the anterior surface of the fragments. When Dr. Rohrer first saw the case, the upper fragment was thrust backwards towards the thoracic cavity, fully one inch behind the level of the other; but it was easily restored to its natural situation by bending the chest backwards over a thick pillow. The pain at the seat of fracture was comparatively slight; but the suffering in the back of the neck and head was very distressing. There was neither cough nor emphysema, and the fever that followed was slight.

The *prognosis* of fracture of this bone varies according to the mildness or severity of the accompanying lesion. When the thoracic organs have sustained much violence, the patient may die from shock, hemorrhage, or emphysema; or, if he be so fortunate as to survive the immediate effects, he may perish from the secondary consequences of inflammation of the lungs, abscess of the mediastinum, or disease of the bone itself. In the Mütter Museum at the Jefferson College is a skeleton in which a fracture of the sternum, near its middle, had undergone perfect reparation, although not without considerable deformity from the want of accurate apposition. Evidence of fracture exists in a number of other bones, and there must also have been a remarkable predisposition in the individual to the development of exostoses.

The *treatment* of fracture of the sternum is in great measure restricted to the application of a compress and bandage, to afford support to the chest, and assist in securing the quietude of the intercostal muscles. If there be any serious internal complications, local and general bleeding, active purgatives, antimonials, and anodynes, may be required, aided, perhaps, by medicated fomentations. If the fracture be simple, no attempt should be made to rectify depression of the offending fragment, unless it is perfectly certain that it acts as a compressing cause of the heart or lung. In such a case, and also when there are loose pieces of bone projecting into the chest, restoration should be effected at all hazard, and that with the least possible delay. To accomplish this, the patient may lie across a table, upon a kind of double inclined plane, in order to extend the spine, and afford the muscles that are attached to the extremities of the sternum an opportunity of drawing the ends of the broken bone asunder. While this is being done, pressure should be made upon the parts in a direction opposite to that of the displacement, at the same time that the lungs are, if possible, thoroughly distended with air. Or, this failing, the bone, the body being still in this position, may, perhaps, be raised by a small, delicate elevator, used subcutaneously, if a wound was not previously made. If this also prove unsuccessful, I should not hesitate, in view of the urgent necessity of the case, to apply the trephine, or to remove a sufficiency of bone with a Hey's saw. A similar proceeding may become necessary when matter forms in the anterior mediastinum, or when a portion of the sternum is assailed with caries or necrosis.

## FRACTURES OF THE VERTEBRÆ.

The vertebræ are so compactly constructed, so strongly articulated, and so thickly covered by muscles as to render their fracture a matter of great difficulty. The most common causes are violent blows or falls, giving rise at the same time to severe injury of the soft parts. Occasionally, but very rarely, the lesion is produced by contre-coup, as when a person falls from a great height and alights upon his feet, the force being transmitted along the extremities and the pelvis to the spinal column, where, concentrating itself upon a particular bone, it breaks its substance or severs its ligamentous connections. Any part of such a bone may give way, its body, plates, and processes being all liable to yield under the influence of the causes here mentioned. The symptoms and effects of this lesion must be considered with reference to the different divisions of the vertebral column, as the cervical, dorsal, and lumbar, each possessing certain peculiarities growing out of its relations with the spinal cord and the nerves which are detached from it.

In fracture of the *cervical vertebræ*, the symptoms vary according to the situation of the affected bone. Thus, if the lesion be above the fourth piece, or the principal origin of the phrenic nerve, and the spinal cord is at all compressed, the diaphragm will be paralyzed, the respiration will be more or less embarrassed, and death will follow, either immediately or within a short time after the accident. If, on the other hand, the fracture is seated below this point, there will be paralysis, to a greater or less extent, of the superior extremities, difficulty of breathing, relaxation of the anal sphincters, incontinence of urine, and tympanitic distension of the abdomen. If the injury done to the soft parts is not very severe, recovery may follow, but in most cases death takes place in from three to five days.

In fracture of the *dorsal vertebræ*, the upper extremities will be free from paralysis, unless the injury is seated very high up, when they may participate in this affection with the sub-diaphragmatic portions of the body. The bowels, in either case, will be torpid and distended with gas, and the bladder will be unable to expel its contents. The patient seldom lives longer than a fortnight, although in some rare cases life is prolonged for several months. In this event, the bowels and bladder may partially regain their original tone, but the urine soon becomes loaded with phosphatic matter, and the lining membrane of the organ suffers from chronic inflammation, adding thus greatly to the patient's distress.

When the *lumbar vertebræ* are broken, the lower extremities are generally deprived both of volition and sensibility, the feces pass off involuntarily, and the bladder is unable to contract upon its contents. Life usually lasts longer than in fracture of the dorsal vertebræ, the paralysis not extending so high up, and consequently not involving so many important organs. In the majority of cases, the patient dies in five or six weeks; but sometimes, though rarely, he survives a much longer time, his bladder, meanwhile, suffering as in fracture of the other divisions of the spine.



The symptoms here enumerated may follow fracture of any portion of a vertebra, except, perhaps, that of the spinous process, where the suffering is generally comparatively slight, unless the lesion is complicated with serious mischief of the spinal cord.

The *diagnosis* of fractured spine is usually rather a matter of inference than of positive conviction. Its most important elements are the mode of production of the injury, and the paralysis of the extremities, but it should be recollected that this symptom may depend entirely upon lesion of the spinal cord, unconnected with fracture of the vertebræ. Owing to the small size of these bones and the manner in which they are covered in by the muscles of the back, it will generally be impossible to detect either crepitation, deformity, or preternatural mobility. All these phenomena may, however, be present in fracture of the spinous processes.

*Dissection*, after an injury of this kind, will usually reveal more or less displacement of the broken bone, which is sometimes quite com-

minuted, laceration of the connecting ligaments, and injury of the spinal cord, with more or less extravasation of blood in the spinal canal and the surrounding parts. The cord is compressed, bruised, pulpified, perhaps nearly completely severed, pieces of bone sometimes being embedded in its substance (fig. 71).

The *prognosis* of these accidents may be inferred from what has been said respecting their symptoms and effects. If the patient escape immediate destruction, he will almost certainly succumb under his suffering at no very remote period; or, if his life should be spared, he will be doomed to carry on a miserable, bedridden existence, palsied and otherwise crippled in the exercise of some of his more important functions.

In the *treatment* of this accident, very little is to be done in the way of restoring displaced fragments, all such attempts being not only uncertain, but, even if successful, likely to aggravate the danger by the additional mischief that is inflicted upon the spinal cord. The same remark is applicable to the operation of cutting down upon the injured part, and removing the offending portion of bone with the trephine or saw, as proposed by the late Mr. Henry Cline, of London, and practised by him and other surgeons. In all the cases, amounting probably to ten or a dozen, in which this procedure has been employed, including those of Dr. John Rhea Barton and Dr. Goldsmith, no particular benefit has followed; a circumstance that might have been expected when it is recollected how seriously the spinal cord is generally injured by the depressed fragment. The operation, although not without difficulty, on account of the great depth at which the offending bone is situated, may be executed by any competent surgeon, with but little loss of blood; and, I must confess that, notwithstanding the want of success which has hitherto attended it, I should

Fig. 71.



feel very much tempted to resort to it, if the symptoms were such as to render it certain that the lesion was accompanied by depression.

Whether an operation be performed or not, it is the duty of the surgeon to adopt prompt measures for the prevention of inflammation; with this view blood is taken freely from the arm, and also by leeches from the seat of the injury; the bowels are relieved by purgatives, or stimulating enemata, and pain is abated by full doses of anodynes, combined, if there be much fever, with antimonials. The bladder is carefully watched, and the urine, if retained, is drawn off regularly twice or thrice a day, instead of allowing the catheter to remain permanently in the bladder. The patient should be kept on his back, upon an air-bed, his head resting upon a low pillow, and his position being as seldom changed as possible. Great care is taken that he is not turned upon his face for any purpose whatever, as he might be almost instantly asphyxiated while in this situation, from the imperfect descent of the diaphragm, caused by the pressure of the abdominal viscera, on account of the paralyzed condition of the abdominal muscles, and their consequent inability to offer any resistance to the weight of the body. After the lapse of five or six weeks, the back and limbs should be frequently rubbed with stimulating liniments, and a large issue should be established in the vicinity of the injury with the Vienna paste or the actual cautery. Along with these means trial may be made of small doses of strychnine, in union with iron and quinine.

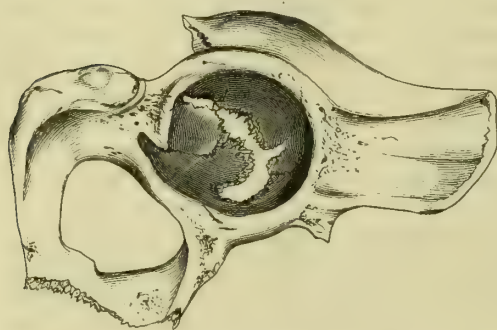
When the lesion is confined to the spinous processes, the fragments must be moulded into shape, and retained by two long, thick compresses, stretched along the side of the spine, and secured with a circular bandage, fastened by a scapulary. If the broken pieces, however, be much shattered, so as to preclude the possibility of their reunion, the best plan will be to remove them.

Fracture of the *odontoid process*, although a very uncommon occurrence, is sometimes met with, and, as might be supposed, generally proves promptly fatal from injury done to the spinal cord. Now and then, however, a remarkable exception is found. Thus, in a case related by Professor Willard Parker, the patient survived the accident five months, at the end of which time he suddenly expired from displacement of the process, during some inadvertent movement of the head, a result favored by the destruction of the occipito-axoid ligament. The dissection showed that the odontoid process had been completely broken off, and that its lower extremity had been turned backwards towards the spinal cord. The patient was a man, forty years of age, who had been thrown violently from his carriage, alighting upon his head and face, about fifteen feet off. After recovering from the immediate effects of the accident, he was able to resume his business as a milkman, which he followed, diligently and uninterruptedly, every day for four months. He complained, however, constantly, from the time of the accident, of pain in the occipito-cervical region, and was always obliged to support his head, which he was incapacitated from rotating. The only visible deformity was a protuberance on the neck, just below the base of the occiput, to the left of the median line, with a corresponding indentation.

## FRACTURES OF THE PELVIC BONES.

a. The *innominate bone* may give way in various parts of its extent, but the one which is most apt to suffer is the upper crest, owing

Fig. 72.



Fracture of the acetabulum.

probably to its exposed situation. The acetabulum is sometimes broken by a severe blow upon the hip, or by a counter stroke, as when a person falls upon his knee or foot, thereby driving the head of the femur into the pelvis. In the adjoining cut (fig. 72), from a preparation in the possession of Professor Neill, the fracture runs in a semi-circular direction through the acetabulum.

In young subjects, the innominate bone is occasionally separated at the acetabulum into its three primitive pieces. Whatever may be the site, form, or extent of the fracture, it can happen only through the agency of direct mechanical violence, which, at the same time, generally seriously compromises the soft structures, both outside and inside the pelvis. The most frightful accidents of this kind that have fallen under my observation, have been the result of railroad injury, caused by the body being jammed in between a car and a wall, literally crushing the bone, and fatally implicating the bladder and other organs.

The *symptoms* of this accident will necessarily vary according to the seat and extent of the fracture. When the bone has given way at the cotyloid cavity, the nature of the case may usually be recognized by the circumstance that the head of the femur is drawn upwards, and the great trochanter somewhat forwards, so that the limb is diminished in length, and the foot inverted. When the head of the thigh bone is impacted in its new position, the limb may be firmly fixed, as in dislocation, but, in general, it will be found to be more or less movable, and to afford a distinct crepitus when an attempt is made to rotate it.

b. In fracture of the *pubic* and *ischiatric* bones, the corresponding limb is either somewhat shortened, or it retains its natural length; the fragments are pushed either directly downwards, forwards towards the

Fig. 73.



femur, or backwards towards the acetabulum; the patient is unable to sit, stand or walk; and on placing one hand upon the ilium, and the other upon the pubes, crepitation may usually be perceived. A well characterized fracture of the pubic and ischiatric bones is delineated in the adjoining sketch (fig. 73), from a preparation in the collection of Professor Neill.



c. Fracture of the crest of the *ilium* is characterized by more or less displacement, preternatural mobility, and crepitation; the pain is severe, and progression impracticable. The nature of the accident is sometimes rendered apparent by the existing deformity and by slight manipulation.

Besides the above symptoms, denotive of fracture of different parts of the innominate bone, there is always more or less contusion of the external soft parts, and not unfrequently, also, serious injury of the pelvic viscera, followed by loss of motion of the inferior extremities, retention of urine, and other distressing affections. The prognosis should, therefore, be very guarded, as such accidents are generally fraught with danger, death often occurring in a few days from inflammation or extravasation of urine, or at a later period from abscess, phlebitis, and other mischief.

Owing to their peculiar character, it is usually found very difficult to reduce these fractures, or to prevent relapse after this has been done. To effect restoration, our main reliance must be upon pressure, while the maintenance is best accomplished by well arranged compresses, secured by a body bandage. When no displacement exists, all such dressings may very properly be dispensed with. In either case, the utmost quietude is enjoined; the patient must lie upon his back, his shoulders being elevated, and the thighs flexed, to relax the muscles about the pelvis; inflammatory action is promptly dealt with, and the bowels are relieved by stimulating purgatives and enemas. The bladder is carefully watched, retention of urine being relieved by the catheter.

d. The *sacrum* may be broken by falls, blows, gunshot violence, and similar injury. The fracture is generally discoverable, especially when there is displacement, by mere manual examination, as the patient lies upon his abdomen. It is attended with severe pain at the affected part, and great difficulty in walking, accompanied, when there is lesion of the sacral nerves, with paralysis of the lower extremities, retention of urine, and involuntary discharge of the feces. The danger attending this accident is always considerable, on account of the mischief done to the soft parts; hence, even if the patient survive the immediate shock of the injury, he may perish afterwards from the effects of inflammation of the pelvic viscera.

When there is displacement of the fragments inwards, reposition may be attempted by the insertion into the rectum of a stout bougie, a lithotomy scoop, or a vesical sound, care being taken not to do any injury to the mucous membrane; or, if the displacement be very slight, the bone may be left in its new situation, as no harm can be caused by so doing. Backward displacement may be easily remedied by pressure with the finger, relapse being prevented by a compress and a T bandage. Recovery is promoted by rigid recumbency and antiphlogistics.

e. The *coccyx* is sometimes broken by a fall, by a kick upon the buttock, and by the passage of the child's head in labor. The accident is most common in elderly subjects, in whom the joints of this bone have been destroyed by a deposit of osseous matter. The characteristic signs are preternatural mobility, acute pain, and crepitation on

introducing the finger into the rectum. During labor, the occurrence of the accident is sometimes rendered evident by a sense of yielding and a peculiar noise perceived by the attendant as he is engaged in supporting the perineum. If displacement exist, it is remedied by pressure upon the surface and counter-pressure with the finger in the rectum. It is very important, especially in the female, that the coccyx should be preserved in a continuous line with the sacrum, otherwise serious deformity of the pelvis may ensue, interfering with defecation and parturition. After the reduction has been effected, the parts should be supported with a compress, confined by adhesive strips; perfect quietude and lateral recumbency should be observed; and the bowels, without being acted upon at all frequently, should be maintained in a strictly soluble condition.

## 2. SUPERIOR EXTREMITY.

### FRACTURES OF THE BONES OF THE HAND AND FINGERS.

The symptoms of fracture of the bones of the thumb and fingers are so obvious that anything like a formal account of them is quite unnecessary. The treatment is best conducted by a leather, felt, or gutta-percha splint, accurately moulded to the shape of the member and the palm of the hand, to which it must be well secured by appropriate rollers.

The *metacarpal* bones are sometimes broken by machinery, and I have met with two instances in which the fourth and fifth of these pieces had given way under a blow of the fist, the part struck being, in one of the cases, the face, and in the other the forehead. There was marked displacement upon the back of the hand, from the projection of the anterior fragment, with distinct crepitus and swelling of the soft parts, but hardly any pain. The treatment consisted in the use of a well-padded tin case for the palm of the hand, extending from just above the wrist, and of a short, narrow splint for its dorsal surface, firm pressure being made with it over the seat of fracture. Union occurred in a month, with no apparent deformity.

The *carpal* bones are never broken, except by direct violence, which always seriously implicates the soft parts, not unfrequently necessitating removal of the hand. The nature of the accident is usually apparent from the attendant deformity, the excessive pain, loss of function, and crepitus on manipulation. Reposition of the fragments having been effected by pressure and counter-pressure, retention is secured by means of two splints, either of binder's board or wood, long enough to extend from the middle of the forearm to the ends of the fingers, the hollow of the palm being well padded, and the limb supported in a sling.

### FRACTURES OF THE SHAFTS OF THE RADIUS AND ULNA.

The radius and ulna may be broken conjointly by direct violence, or, as more frequently happens, by a counter-stroke, as when a person falls upon the hand, and the force is concentrated by transmission upon the forearm. The fracture, although it may occur at any point, is most

common in the inferior half of these bones, and rarely takes place at the same level, whatever may be its cause. In general, too, it is oblique, and not transverse, as is usually supposed. The nature of the accident is commonly sufficiently apparent from the angularity of the fragments (fig. 74), and their preternatural mobility, to say nothing of the facility of eliciting crepitus on rotating the hand. The patient experiences an inability to supinate and pronate the limb, the forearm is in a state of semi-flexion, and acute pain is felt at the seat of the injury.

The chief danger in this fracture, as it ordinarily exhibits itself, is from the tendency of the ends of the fragments to sink inwards into the interosseous space, and to become united by a common callus, thereby materially impeding the usefulness of the limb, by destroying the functions of supination and pronation. With ordinary care, however, such an accident is not likely to happen, and, in most cases, the consolidation is completed in from thirty to thirty-five days, without any deformity, or ultimate inconvenience. The vicious union here mentioned is well shown in the adjoining drawing (fig. 75), from a preparation in my collection.

The fracture having been adjusted in the ordinary manner, the forearm is bent at a right angle with the elbow, and enveloped by a roller, extending from the fingers upwards. Two thick binder's board splints are next applied along the anterior and posterior surfaces of the broken bones, and secured with the remainder of the bandage. They should be a little wider than the limb, and long enough to reach from just below the elbow to the extremities of the fingers, both being well covered with wadding, and accurately moulded to the parts. The hand and forearm are then suspended in a broad sling, and confined to the chest in such a manner as that the thumb shall look directly upwards.

In my own practice I have, of late years, entirely dispensed with the compresses upon which so much stress has been laid by practitioners for counteracting the tendency which the ends of the fragments have to approach each other at the interosseous space. I am satisfied that they are not needed for this object, and that all the compression that can be required, at least in ordinary cases, can be effected by the two splints, which are always employed in the treatment of fracture in this situation. The bandage, too, has received a great deal of unjust blame in these cases, it being alleged that, if applied directly to the surface, it will force the bones together, and thus bring on the result adverted to in the foregoing paragraph. It would unquestionably be easy enough to produce such an

Fig. 74.



Fig. 75.





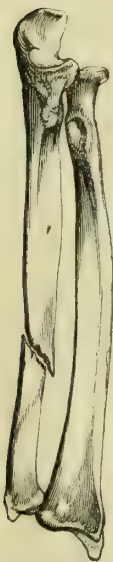
effect, but it need hardly be added that this would be an abuse, and not a proper use of the bandage, its appropriate office being to afford equable support to the muscles of the broken limb for the purpose of preventing swelling and spasmodic action. Whenever it causes such an amount of compression as to force the fragments towards each other, it cannot fail to excite pain and inflammation, if not still worse consequences. It is the manner, then, in which the application is made, and not the application itself, that is objectionable in the treatment of this fracture. As to the splints, they should be carefully moulded to the shape of the limb, a narrow interval being left between them at its radial and ulnar borders. When the binder's board splints cannot be obtained, light pieces of wood may be used.

When the fracture is multiple, consisting, for example, of three fragments, the intermediate one having lost its support, may have a tendency to sink in towards the interosseous space. To counteract this disposition, a thick, narrow pad may be placed along the mesial border of the loose piece, in an opening in the anterior splint, so as to enable the surgeon to make the pressure more firm and direct. But even here such an expedient will rarely be necessary, if the parts have been moulded into position prior to the application of the apparatus.

#### FRACTURES OF THE ULNA.

Fractures of the ulna may with great propriety be divided into those which take place at its body, its inferior extremity and its two principal processes, the olecranon and coronoid.

Fig. 76.



1. *Shaft.*—The body of the bone (fig. 76) is most commonly broken in the lower half of its extent, in an oblique direction, from causes acting directly upon the forearm. The accident may, however, be produced by a counter-stroke; and one instance is known where it was occasioned by muscular action in wringing clothes, the patient being a stout, healthy girl of eighteen. The fracture is evinced by a marked depression at the inner border of the forearm, by the mobility of the fragments, and by the crepitus on rotating the hand. The lower fragment alone is generally displaced, being drawn over towards the interosseous space by the inferior pronator muscle, while the other, in consequence of its firm connection with the humerus, remains stationary. An exception to this is seen in the adjoining figure.

Great care is necessary in the treatment of this fracture, lest the upper end of the lower fragment retains the vicious position into which it is forced at the time of the accident, and is induced ultimately to become soldered to the inner margin of the radius. To prevent this occurrence, the hand should be permanently inclined towards the thumb, the means for doing this being two splints, the extremities of which are rendered somewhat sloping from behind forwards, in a direction opposite to that of the splints employed

in the management of fracture of the corresponding end of the radius. Such an expedient will be much more efficient than the use of the long, thick, and narrow compress, generally recommended for that purpose.

The head of the ulna is sometimes broken off, either separately, or along with the head of the radius. The circumstance is easily detected by the mobility of the part, by the disabled condition of the wrist-joint, by the severity of the pain, and by the concomitant distortion. The treatment is conducted with two splints, aided, if necessary, by two compresses applied directly over the seat of the fracture.

2. *Olecranon Process.*—Fracture of the olecranon (fig. 77) is caused either by direct violence, or by the inordinate action of the three-headed

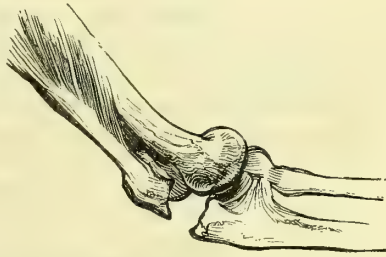
Fig. 77.



extensor muscle, attached to its upper extremity. Situated at various points of its extent, the fracture may be transverse or oblique, single or multiple, simple or complicated.

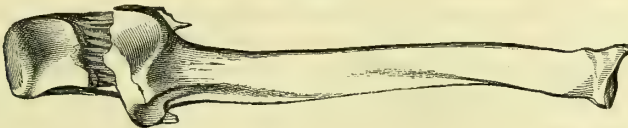
The *symptoms* are, semiflexion of the limb, impossibility of extending the forearm, a hollow at the back of the elbow (fig. 78), and a movable prominence at the postero-inferior surface of the arm, along with more or less pain and swelling. The interval between the two fragments varies from one and a half to two inches, and may be augmented or diminished at will by moving the forearm. The radius may be rotated upon the ulna, and crepitus may be elicited by the approximation of the extremities of the broken bone. Sometimes the very tip of the olecranon is severed, and then there is no separation of the fragments. The same thing may happen when the fracture is oblique, or transverse, provided it is not below the ligamentous expansion of the extensor muscle.

Fig. 78.



The *union* of this fracture is generally fibro-ligamentous, as seen by the annexed sketch (fig. 79), from a specimen in my collection. The

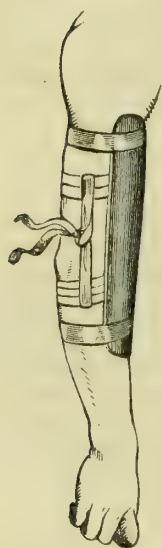
Fig. 79.



cause of this kind of union is threefold; first, the want of proper nourishment of the upper fragment; secondly, the difficulty of maintaining

accuracy of apposition; and, lastly, the accumulation of an inordinate deposit of synovial fluid, all, but especially the first, interfering with the healing process. I have, in a few instances, seen osseous union; but such an occurrence is extremely rare, and is not at all likely to happen if there be any considerable separation of the fragments, or when the fracture extends through the lower part of the process. The period

Fig. 80.



required for the repair of the injury varies from six to eight weeks, and many months generally elapse before the patient regains a good use of his limb. When the lesion is of a complicated nature, violent inflammation of the elbow-joint may arise, sometimes ending in permanent ankylosis.

The *treatment* consists in maintaining the limb in the extended position, by means of a wooden splint, long enough to reach from the fore part of the middle of the arm to the same point of the forearm (fig. 80). A roller having been applied from the fingers upward, the small fragment is drawn into its proper place, where it is confined by a few long adhesive strips and a compress, the whole being firmly secured by carrying the roller round the joint somewhat in the form of the figure 8; or, instead of this, the arm is bandaged from the shoulder downwards, so as to obtain a more perfect control over the extensor muscle, the great agent in effecting displacement. Passive motion is instituted at the end of three weeks, and frequently renewed, to prevent ankylosis. If the fracture is associated with severe injury of the soft parts, leeches, fomentations, and other antiphlogistic measures must be employed.

3. *Coronoid Process*.—A considerable number of cases of fracture of the coronoid process (fig. 81) of the ulna have been reported, both in

Fig. 81.



systematic treatises and in medical periodicals, but it is very questionable whether even a minority of them should be considered as true examples of that lesion. I have myself never met with the accident in the living subject, and I am not aware that a solitary specimen of it exists in any of the osteological collections, private or public, in the United States. Professor Hamilton, who has investigated this subject with his usual care and ability, is very decidedly of the opinion that most of the published cases of this accident are unworthy of acceptance, either because they were badly observed or imperfectly reported, and because the existence of scarcely any of them has been verified by dissection. Some years ago, an instance of reputed fracture of the coronoid process occurred in a young man, a patient in the Louisville Hospital; but, although the symptoms were such as are usually



described as characteristic of that lesion, I am by no means satisfied that it really was of that nature. In the case of a boy, about nine years of age, treated by Dr. A. A. Scott, of Missouri, by whom the particulars have been kindly communicated to me, the coronoid process is stated to have formed a distinct prominence upon the anterior and inferior surface of the humerus, a short distance above the joint, movable from side to side, the olecranon being at the same time displaced slightly backwards, and the forearm somewhat flexed. The accident was caused by a fall upon the hand while the arm was forcibly extended.

If we may credit the reported cases of this fracture, it is evident that it takes place mostly in young subjects. It has generally been supposed that it may be caused by inordinate contraction of the anterior brachial muscle; but if any one will take the trouble to examine this muscle at its lower extremity, he will find that it is impossible for it to produce this effect, since the only connection which it has with this portion of the ulna is at the very base of the coronoid process, all the rest of the prominence being entirely free, and therefore beyond the reach of the influence of the anterior brachial. Such an accident might possibly occur in this way if the coronoid process were, like the olecranon, an epiphysis, but this is not the case. Hence the most reasonable conclusion is that fracture of this prominence is always produced either by direct injury, as by the passage of the wheel of a carriage, or, as probably more commonly happens, by force applied to the hand, impelling the ulna and radius violently upwards against the lower extremity of the humerus.

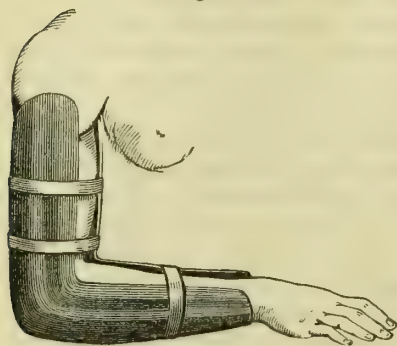
In whatever manner the fracture is produced, the *symptoms* are not generally so clearly marked as one might at first suppose. That this is the fact is sufficiently evident from a study of the reputed cases of the accident, in which the diagnosis has generally been attended with unusual difficulty. The ulna, having lost its purchase in front, will necessarily be drawn backwards and upwards by the action of the three-headed extensor muscle, so that the accident will present all the appearances of a dislocation of the bone in this direction, the prominence of the olecranon being characteristic. The patient is unable to flex the limb, and the detached portion of bone can be felt just above the elbow, where it may be readily grasped and moved about, especially soon after the accident, before any swelling has come on. By bending the forearm at a right angle with the arm, and drawing down the fragment of bone, crepitation might possibly be elicited, but this must, in any event, be very faint and indistinct. The accidents with which this fracture is most liable to be confounded are fracture of the humerus and dislocation of the ulna and radius backwards.

The *union* of this fracture is universally considered as taking place by fibro-ligamentous tissue, and there is no doubt that this is the fact, as appears sufficiently evident when we reflect upon the small size of the detached piece of bone, the difficulty of keeping it in place, its imperfect nourishment, and its close connection with the joint; circumstances which are so many impediments to the formation of osseous matter.

In young subjects, and under proper management, a cure may generally be looked for in four or five weeks.

The *treatment* is quite simple, being conducted with a view to the thorough relaxation of the flexor muscles of the arm. For this

Fig. 82.



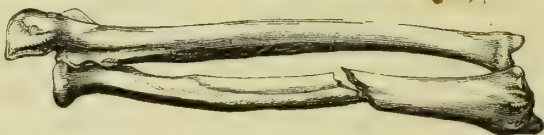
purpose, the forearm, after having been carefully bandaged from the fingers up as far as the elbow, and the arm from the shoulder downwards, in the opposite direction, is placed at a right angle, in a tin-case or suitable splints (fig. 82), and supported in a sling, care being taken to prevent the radius and ulna from slipping backwards, away from the condyles of the humerus. The fulfilment of this indication will generally be materially aided by the use of adhesive strips, carried around the joint in the same

manner as in fracture of the olecranon. Passive motion should be instituted at the end of three weeks, and perseveringly renewed from time to time, lest ankylosis ensue.

#### FRACTURES OF THE RADIUS.

1. *Shaft*.—Fracture of the body of the radius may take place independently of that of the ulna (fig. 83), and is the more frequent acci-

Fig. 83.



dent of the two; its most common seat is the inferior half of the bone, and its ordinary cause a fall upon the palm of the hand. Dr. Packard has reported a case of fracture of the upper portion of the radius, caused by violent muscular exertion in driving a pair of horses.

The *symptoms* are usually well marked, there being more or less deformity, preternatural mobility, inability to perform the motions of pronation and supination, and the detection of crepitus upon rotating the hand. The ends of the fragments have a singular tendency to approach the interosseous space, and hence, if the case be not judiciously managed, there is apt to be permanent distortion, with partial loss of function of the limb. One of the evil consequences of this tendency is the want of osseous union, or the formation of a false joint within two and a half or three inches of the wrist. I have seen a number of well-marked examples of this kind, and I know of no

fracture where an unskilful surgeon may show his ignorance to greater disadvantage.

The limb, being bandaged in the usual manner, is steadied by two splints, extending as far forwards as the extremities of the fingers, the hand being inclined inwards towards the ulna, and maintained in a state midway between pronation and supination. For this purpose, the ends of the splints should be shaped somewhat like the handle of a pistol, as this arrangement will afford an opportunity of bearing upon the radius in such a manner as to force the lower fragment outwards in contact with the superior, thereby counteracting the tendency above alluded to. If this point be strictly attended to, the cure can hardly fail to be perfect. Ordinarily consolidation may be looked for in four weeks.

2. *Superior Extremity.*—This bone is occasionally broken at its superior extremity, the fracture detaching its rounded head, or extending through its neck. It is very rare that the bone gives way at the bicipital tubercle. The injury could hardly be produced in any other way than by direct violence. Owing to the manner in which the parts are enveloped by the muscles, the symptoms are usually indistinct, and the diagnosis is, consequently, rather difficult.

The usual *symptoms* are deformity just below the elbow-joint, caused by the flattening of the muscular prominence in that situation; the projection of the upper end of the lower fragment in front of the limb, being drawn thither by the two-headed flexor muscle, impossibility of executing the functions of rotation, and the rapid supervention of severe swelling. To render the diagnosis certain, the best plan is to grasp the head of the radius with the thumb and index finger of one hand, and to rotate the forearm with the other. If there be fracture, its existence will be rendered evident by the head of the bone refusing to obey the motions of the inferior fragment. By adopting this manoeuvre, it will hardly be possible to mistake the nature of the case, unless there be so much swelling as to prevent the bone from being felt, in which event the examination must be repeated when the tumefaction has measurably subsided.

In the *treatment* of fracture in this situation, the limb is placed at a right angle with the arm, in a state midway between pronation and supination, and the same splints are employed as in fracture of both bones of the forearm, care being taken to extend them as high up as possible, in order that they shall afford adequate support to the upper fragment. When there is great disposition in the pronator muscle to draw the lower fragments over towards the interosseous space, a compress may be used, but not otherwise.

The annexed drawing (fig. 84), from a preparation in my collection, exhibits a rare form of fracture, in which a portion of the

Fig. 84.





head of the radius has been chipped off, and permanently united to the contiguous border of the coronoid process of the ulna. The specimen was obtained in the dissecting-room, and nothing is, therefore, known of its history.

*Inferior Extremity.*—The frequency of fracture of the lower extremity of the radius, its liability to be confounded with dislocation of the wrist-joint, and the imperfect recovery of the functions of the hand which so often follows it, sufficiently attest the importance of the subject, and afford a satisfactory reason for the extraordinary attention that has been accorded to it by modern surgeons. Among those who have particularly interested themselves in elucidating the question, I am happy to mention Dr. John Rhea Barton, who, in a short, but graphic paper, published in the Philadelphia Medical Examiner for 1838, was the first to describe, with any degree of accuracy, the nature and treatment of fracture of this bone at the radio-carpal articulation. In 1814, Dr. Colles, of Dublin, gave an account of a fracture which he had repeatedly found at the distance of about an inch and a half above the joint, and more recently the whole question has been examined anew by some of the French and British surgeons, particularly Mr. R. W. Smith, of Dublin.

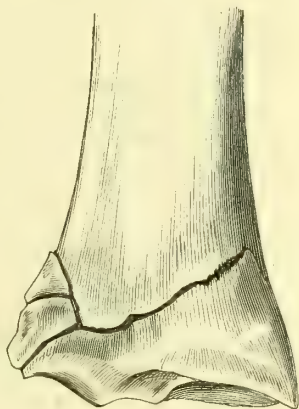
Two circumstances powerfully contribute to the production of this fracture, namely, the large amount of spongy substance entering into the composition of the inferior extremity of this bone, and the peculiarity of its connection with the wrist-joint. The relative quantity of this matter in its lower and middle portions, and also the difference in their compact structure are very striking. These appearances, which are sufficiently conspicuous even in young subjects, are remarkably prominent in elderly persons, in whom the spongy substance of this part of the bone is generally exceedingly rarefied and infiltrated with oily matter, while the compact is often merely a thin crust, hardly as thick as an egg-shell, and scarcely less brittle. The peculiar mechanism of the wrist-joint cannot fail to strike the surgeon. From the intimate manner in which the radius is articulated with the scaphoid and semilunar bones, any shock received upon the palm of the hand is readily communicated to it, causing it, if at all severe, to give way under its influence; whereas the ulna, which has no such close relation, generally escapes without injury. Fracture of the lower extremity of the radius may happen at any period of life, but is most common in middle aged and elderly subjects. As the result of indirect violence, I have not seen an instance before the eleventh year.

Respecting the *site*, direction, and extent of fracture of this part of the radius, the greatest possible diversity exists. Generally the injury is situated low down, within a short distance of the joint or within the joint; but the line of fracture is often considerably higher up, as an inch, an inch and a quarter, and even an inch and a half, at the junction, or even beyond the junction, of the lower extremity of the bone with its shaft. Sometimes the seat and direction of the fracture correspond to the line of union of the epiphysis.

In regard to its *direction*, the fracture is generally oblique, ex-

tending from above downwards, and from the dorsal to the palmar surface. Of forty-seven cases analyzed by Mons. Goyrand, of Aix, forty-three were of this description, the degree of obliquity varying much in different instances, the fissure being sometimes almost horizontal.

Fig. 85.



The fracture of the lower end of the radius is frequently *multiple*, or comminuted; indeed, I am inclined to believe that this form of injury is more common than the simple. In the annexed drawing (fig. 85), from a preparation in the pathological collection of the New York Hospital, there are four fragments, and in several cases I have seen as many as five and six. Occasionally there are two fissures, one transverse, or nearly so, and the other vertical, detaching the head of the bone from its shaft. In Barton's fracture, the lesion always extends through the articular surface of the bone, and is frequently attended with separation of the styloid process.

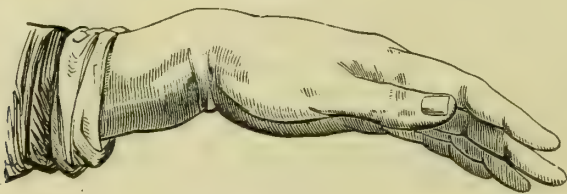
Fracture in this situation may be *complicated*, first, with fracture of the styloid process of the ulna, or of the head and shaft of that bone; secondly, with dislocation of the wrist-joint; and, thirdly, with serious injury of the soft parts. Some years ago I attended, along with Dr. Chenowith, a young man in whom this bone was split in two by a transverse and oblique fissure, the larger fragment being completely detached, and thrown forwards and inwards over the ulna, whence, as it was impossible to replace it, I removed it by incision. A good recovery took place with hardly any impairment of the functions of the wrist-joint. In my private collection is a specimen of transverse fracture of the lower extremity of the radius, extending into the joint, and detaching the head of the bone by several small, vertical fissures. In this case I had an opportunity of dissecting the parts in consequence of the removal of the forearm, above its middle, by another surgeon, several weeks after the occurrence of the accident. The hand and wrist were much swollen, and infiltrated with pus, which was also freely diffused through the sheaths of the flexor tendons, while the cellular tissue along the inner part of the palm contained a good deal of blood. The joint was filled with matter, and the scaphoid and semilunar bones, as well as the ulna, which was dislocated backwards, were almost completely divested of cartilage.

The ends of the broken pieces are sometimes *impacted* in this fracture, the superior being driven into the cancellated structure of the inferior; but such an occurrence, although said to be common, is, if I may judge from the cases that I have had an opportunity of examining, quite infrequent. When the force causing the impaction is very great, the inferior fragment may literally be crushed by the superior.

The accident nearly always results from a fall upon the hand, in which the patient, stretching out the limb, receives the shock upon the palm, whence it is transmitted to the inferior extremity of the radius. Occasionally, though much more rarely, the fracture takes place by a fall upon the back of the hand. The lesion is also produced by direct violence.

The most conspicuous *symptom* of this fracture is the singular deformity of the hand, giving the limb the appearance of a dislocation of the wrist-joint (fig. 86). This is owing to the fact that the lower

Fig. 86.



fragment along with the carpus is drawn upwards and backwards, from an inch to an inch and a half above the joint, by the action of the extensor muscles of the thumb, while the upper fragment forms a slight projection on the palmar aspect of the forearm. Immediately above the posterior prominence is a well marked depression, which gradually slopes off towards the ulna, and is generally sufficiently large to receive the little finger. These appearances are always very striking when the limb is held in a situation midway between pronation and supination, and are easily effaced by extension and counter-extension, although they are promptly reproduced when these forces cease to act. The lower extremity of the forearm has a rounded form, from the increase of its antero-posterior diameter; the fingers are usually flexed, and the patient is unable to supinate the hand, which is, moreover, completely powerless; the pain is excessive, and considerable swelling soon arises, especially along the palmar aspect of the limb. Crepitus may usually be detected by pressure just above the wrist-joint. With these phenomena before him, a surgeon must be exceedingly stupid if he does not speedily detect the nature of the injury.

Instead of being thrown backwards, the inferior fragment is sometimes forced in the opposite direction, forming a projection in front of the forearm, beneath the flexor tendons. Another tumor, more conspicuous, and consisting of the lower extremity of the radius, occupies the dorsal surface; it extends across the entire breadth of the limb, and is bounded above by a well-marked furrow, more distinct internally than externally. The accident, which is exceedingly rare, closely simulates dislocation of the carpus forwards, but may readily be distinguished from it by the presence of crepitus, and the facility with which the symptoms can be made temporarily to disappear under slight manipulation.

The adjoining sketch (fig. 87) represents a fracture of the inferior extremity of the radius, complicated with luxation of the ulna. The



signs of both injuries are characteristic. The drawing was taken from a private patient.

The *prognosis* of this fracture is greatly influenced by the nature of the case and the manner in which it is managed. If, as occasionally happens, there is no displacement, or serious complication, consolidation may be looked for in from twenty-five to thirty days, without deformity or permanent impairment of function. Under opposite circumstances, nothing but the utmost care and circumspection will be likely to insure a successful cure. In any event, the patient must not expect to regain the complete use of his wrist and fingers for several months, as there is a great tendency, in almost every case of the kind, in the resulting inflammation to extend to the synovial membrane of the digital articulations and of the sheaths of the tendons. This fact should always be explained to the patient at an early stage of the treatment, otherwise the surgeon may be unjustly censured for what he cannot possibly avoid.

Among the various contrivances for maintaining the contact of the fragments, I may mention, as an excellent one, that devised by Dr. Henry Bond, of this city, which I can recommend, from my own experience, as well calculated to fulfil every indication that can be presented by such an injury. It consists of two splints (figs. 88, 89), one

Fig. 87.

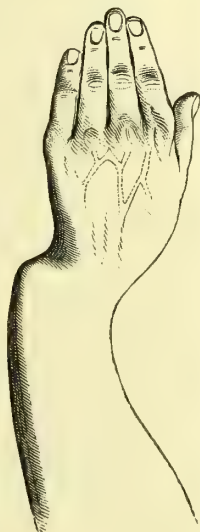
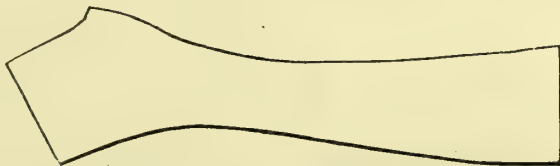


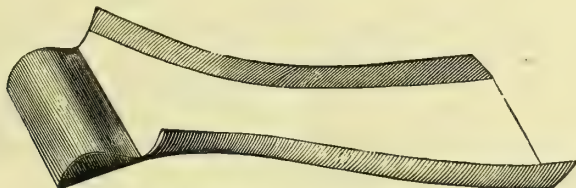
Fig. 88.



Bond's splint—the part for the back of the forearm.

of medium-sized binder's board, and the other of thin, light wood, furnished with a block and edges of thin sole-leather, about an inch

Fig. 89.



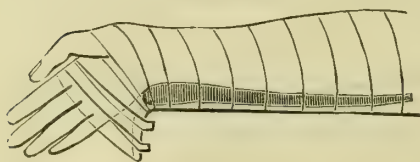
The same, for the front of the forearm and hand.

in height, the whole presenting somewhat the appearance of a shallow trough. They are long enough to reach from a short distance below

the elbow to within an inch of the knuckles of the metacarpal bones, the block of the latter resting in the hollow of the palm, and both being well padded with wadding. Having encircled the thumb and each finger with a narrow bandage, the better to control the resulting swelling, and the fracture having been adjusted by pressure and extension, a roller is next passed around the limb as high up as the superior part of the forearm, special care being taken that it shall not produce the slightest constriction anywhere. The splints are then placed in their proper position, and fastened in the usual manner. If there be any tendency to displacement, which, however, rarely happens after the first few days, a narrow, square compress, not more than a third of an inch in thickness, is laid over the projecting fragment, to give greater concentration and effect to the pressure of the apparatus opposite to the seat of fracture. Sometimes it is found necessary to use a compress on each side of the wrist; but such is the accuracy with which the palmar splint fits the parts that this portion of the dressing may generally be altogether dispensed with. There is no use in any case of an interosseous compress, as there never is any tendency in the fragments to inward displacement. The advantage of the apparatus of Dr. Bond is that, while it maintains the thumb perfectly at rest, and consequently prevents its extensor muscles from disturbing the fragments, it permits the patient to move his fingers about freely in front of the block; a circumstance of no trifling importance in an accident so liable to be followed by inflammation of the sheaths of the tendons. The hand and forearm are, of course, supported in a sling.

In the absence of Dr. Bond's apparatus, a good dressing may be made of two thin pieces of wood, or stout binder's board, a little wider than the forearm, well padded, and of the same length as the preceding,

Fig. 90.



care being taken, in applying them, to fill up the hollow of the hand and the intervals between the splints and limb with cotton. It will also be well, in this case, to give the anterior extremities of the splints a sloping inclination from above downwards, so as to put the extensors of the thumb slightly upon the stretch, as seen in the annexed cut (fig. 90).

The above dressings will answer equally well, whatever may be the character of the displacement, whether backwards or forwards. Passive motion is instituted at the end of a fortnight, proper support being given to the fracture while this is being made. The proceeding is afterwards repeated every other day, until the end of the fourth week, when the apparatus may generally be discontinued, the bandage alone being used. If the joints of the fingers are stiffened, they should receive special attention at each dressing.

#### FRACTURES OF THE HUMERUS.

Fractures of the humerus are of frequent occurrence, and are of great practical importance, from the difficulty which so often attends

their diagnosis and treatment. They may take place in the shaft of the bone, at its surgical neck, at its head within the capsular ligament, and at its condyles.

1. *Shaft*.—The simplest fractures of the humerus are those which occur in its shaft, as they are most easily detected and treated, and least liable to be followed by deformity and loss of function. Caused occasionally by direct violence, they more frequently result from falls upon the palm of the hand, in attempts to save the body from more serious injury. In several instances that have come under my observation, and which are alluded to in another part of this section, the accident was produced by muscular contraction; in one case, while the patient was in the act of throwing a chip. The fracture is usually oblique, a transverse one, properly so termed, being exceedingly uncommon. A complicated fracture of the shaft of the humerus is occasionally met with, as a consequence of the explosion of firearms, the contact of machinery, or the passage of the wheel of a carriage.

The *symptoms* of fracture of the humerus in this situation are usually characteristic, the deformity, preternatural mobility, and crepitus being well marked. In general there is some shortening, but the amount of this varies very much, according to the obliquity of the fracture and the development of the limb; in ordinary cases, it is very slight, the weight of the arm being sufficient to counteract the action of the muscles, at least to a considerable extent. The direction of the displacement is regulated by the line of fracture; if this is below the insertion of the deltoid, the inferior fragment will be drawn inwards, but outwards if it be above that point. However this may be, any deformity that is present is easily effaced by extension and counter-extension. The limb is completely powerless, and is always supported by the patient at the wrist.

The *treatment* of this fracture is very simple, the only apparatus necessary being two splints, and a roller applied from the fingers up. The splints may consist of two stout pieces of unoled sole-leather, or binder's board; one extending from the axilla to within an inch of the internal condyle, and the other from the shoulder-joint to the corresponding point of the outer condyle, the two, when applied, nearly meeting each other. By soaking them in hot water, they may be accurately moulded to the shape of the limb, and, when this is done, it is impossible to conceive of anything better adapted for the treatment of such a case. The forearm and hand are, of course, supported in a sling, and, for the sake of greater security, the arm may be fastened by a few turns of a bandage to the side of the trunk, though this is not at all essential. Special care is taken not to raise the elbow, as a certain degree of weight is necessary to prevent overlapping of the fragments. This mode of dressing fractures of the shaft of the humerus I have practised for many years, and it requires no argument to show its superiority over the old four-splint apparatus, still used by many surgeons. If the lesion be simple, reunion will generally occur in a month.

2. *Inferior Extremity*.—Fracture of the condyles may be caused by a fall upon the point of the elbow, by a blow, or by the passage



of the wheel of a carriage. I have repeatedly known it to be produced by a fall upon the palm of the hand, the limb being at the time in an extended position. The accident may be simple, or, as not unfrequently happens, complicated with serious mischief to the joint and soft parts. Both condyles may be broken, or one only may be affected. In the former case, a longitudinal fracture usually extends some distance along the centre of the bone, and then terminates, probably at a distance of an inch and a half to two inches above the joint, in an oblique or transverse fissure in the lower portion of the shaft of the humerus, thus producing three fragments. Not unfrequently, however, there is a separation merely of one of these prominences, the fracture being then usually directed obliquely downwards into the joint. In a third series of cases, the small projection over the inner condyle is broken off, either obliquely or perpendicularly, without any involvement whatever of the articulation.

The *symptoms* of fracture of this portion of the humerus vary according to circumstances, as might be expected from a consideration of the component structures of the elbow-joint. When both condyles are severed just above the articulation, the radius and ulna project backwards, a hollow exists at the bend of the arm, the forearm is slightly flexed, and the distance between the elbow and wrist is sensibly diminished. When the fracture involves both the condyles and the inferior extremity of the shaft of the bone, there will be, in addition to these phenomena, an increase in the width of the bend of the arm, and an appearance of greater flattening. The accident, whether accompanied by this occurrence or not, is liable to be mistaken for dislocation of the radius and ulna backwards; but the diagnosis may generally be readily determined by the fact that the symptoms which mark the former lesion promptly disappear on extending the limb, and that crepitus may be produced when the forearm is rolled upon the humerus.

When the inner condyle (fig. 91) alone is detached, the ulna pro-

Fig. 91.



jects backwards, but resumes its natural position on extending the limb; the condyle forms a tumor at the back part of the elbow; crepitus is perceived on bending the forearm; and, if the forearm be extended, the humerus will advance in front of the ulna as the latter recedes.

A fracture of the external condyle (fig. 92) is characterized by the

Fig. 92.



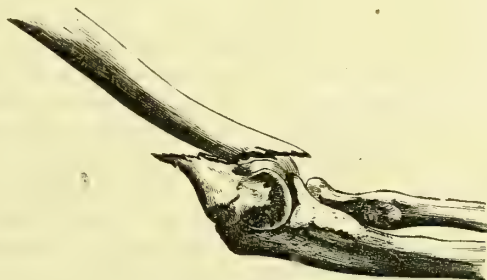
existence of a tumor at the outer and back part of the elbow, by crepitation on rotating the radius, by the supine position of the hand, by inability to move the joint, and by the constant semiflexion of the forearm.

When the tubercle over the internal condyle is broken off, the diagnosis is easily established by the great mobility of the fragment, the ready production of crepitus, and the other ordinary signs of fracture. The accident is usually caused by a fall upon the elbow, and is unaccompanied by any displacement of the bones of the forearm.

Whatever may be the nature or extent of these fractures in the vicinity of the elbow-joint, there are always severe pain and complete inability to move the limb. Considerable swelling soon follows, and effusion rapidly takes place within the articulation, obscuring the characteristic features of the injury, and rendering the diagnosis proportionally difficult. When such a state of things exists, leeches, fomentations, and other antiphlogistic measures may be necessary before the parts will be sufficiently tolerant of the requisite manipulation.

The inferior extremity of the humerus occasionally gives way just above the condyles, generally in a more or less oblique direction, as seen in the accompanying drawing (fig. 93). Such an occur-

Fig. 93.



rence may, unless great care be taken, be readily confounded with dislocation of the ulna and radius backwards, which its symptoms, at first sight, closely resemble. The signs of distinction are, the mobility of the limb, and the facility with which the parts can be restored to their natural position, followed by the immediate return of deformity upon discontinuing the extension. The accident, which should be treated on the same principles as fracture of the shaft of the humerus, is extremely liable to be followed by stiffness of the joint.

In children, prior to the completion of the ossific process, there is sometimes a separation of the epiphysis of the inferior extremity of the humerus, induced by falls upon the hand or elbow. The symptoms resemble those of fracture in this situation in the adult, there being an unnatural projection at the back of the joint, caused by the retraction of the lower fragment along with the bones of the forearm, and the ready production of crepitus on extending the limb. The accident is treated as if it were a fracture.

I know of no fractures which I approach with more doubt and misgiving than those of the inferior extremity of the humerus, involving

the elbow-joint. I know of none which are more liable to be followed by severe inflammation of the synovial membrane, extensive effusion, ankylosis, and deformity. Even in the more simple forms of these injuries, and where the treatment has been most skilfully conducted, there is generally great risk of an unfavorable result; at all events, a long time will be sure to elapse before there will be anything like a good use of the articulation. The prudent surgeon will, therefore, inform his patient, at the commencement of the attendance, of the nature and probable consequences of the case. From five to six weeks is the average period necessary for the reunion.

The nature of the deformity, in badly-treated fracture of the condyles of the humerus, may exhibit itself in quite a variety of ways, depending upon the peculiar mode of treatment. Sometimes a posterior projection remains, caused by the displacement of the lower end of the bone backwards; not unfrequently the limb has a strangely twisted appearance, either in the direction of pronation or supination; occasionally it is permanently flexed or extended; and sometimes, again, the limb is greatly increased in breadth.

Most practitioners, I believe, are agreed upon the propriety of treating these fractures with the limb in the flexed position. I know of but few that pursue the opposite plan, and the arguments which they have adduced in its favor have by no means convinced me that it is at all equal to the other method. It is but just to say, however, that I know nothing of its comparative merits from experience, inasmuch as I have never, in a solitary instance, adopted it, having always been satisfied with the rectangular position. To maintain the limb in this situation, I have long been in the habit of employing a light and well-shaped tin-case, extending from the axilla to the metacarpo-phalangeal articulations. This being properly lined with wadding, affords an admirable support to the limb, and effectually prevents displacement of the fragments, whatever may be their size or number. Great care should be taken to protect the inner condyle from pressure, otherwise it may become seriously inflamed, if not ulcerated. To obviate this occurrence, a small gap may occasionally be made with advantage in the case, opposite this ledge of bone. A case made of gutta percha, felt, thin wire, or sole-leather, answers quite as well as one of tin, and is even superior to it, inasmuch as it admits of more accurate adaptation to the irregularities of the limb. The forearm is supported in a sling, in a state midway between supination and pronation.

There are no fractures which require more constant vigilance after their adjustment than those about the elbow-joint. The dressings should, therefore, be examined for some time, from day to day, in order that they may be changed whenever they become either too tight or too slack, and especial pains must be taken that the bandage, in the first instance, is applied very loosely, due allowance being always made for the resulting swelling. If some time have elapsed since the occurrence of the injury, and the pain and tumefaction are very severe, measures should be used to reduce the inflammation before the limb is put up. Passive motion is commenced at the end of two weeks, and repeated every forty-eight hours until all danger of anchy-



losis is passed. As soon as the fracture is sufficiently repaired to bear the change, the rectangular apparatus is taken off, and a more obtuse one substituted in its place.

Fractures of the elbow are often of a *complicated* character (fig. 94), especially when caused by railway injury, or falls from a great height;

Fig. 94.



Complicated fracture of the elbow.

penetrating the joint, extensively lacerating the soft parts, and, perhaps, comminuting the bones. Such accidents are always fraught with danger, both to limb and life, and usually promptly require amputation. Even supposing that the limb could occasionally be saved under such circumstances, the patient's recovery will be extremely tardy, and when, at length, he does get well, it will be found, as a general rule, that the joint will be worse than useless, only serving as a hinderance.

3. *Superior Extremity*.—The superior extremity of the humerus includes the hemispherical head of this bone and its two necks, the anatomical and surgical; the former being the narrow, constricted portion between the head and its tuberosities, and the latter all that portion which intervenes between these prominences and the insertion of the broad dorsal muscle, its length varying from an inch and a half to two inches, according to the stature of the individual.

a. *Fracture of the Head*.—Fracture of the head of the humerus is an extremely uncommon occurrence, so much so, indeed, that its possibility was for a long time a matter of controversy among surgeons. The cases, however, that have been reported by Bichat, Astley Cooper, Dorsey, Gibson, R. W. Smith, Malgaigne, and others, have effectually dispelled all doubt upon the subject. I saw, myself, many years ago, in a patient of Dr. George McClellan, an instance of the kind, which had been mistaken by the attendants for a fracture of the acromion process, and the true nature of which was not detected until several years after the occurrence of the accident, when the man, who was upwards of forty years of age, died of another disease, and an opportunity was thus afforded of examining the parts. The fracture had extended obliquely from above downwards through the head of the bone; and, although it had become perfectly consolidated, there were several rough prominences which, while they unmistakably indicated the seat of the injury, greatly impeded the movements of

the shoulder-joint. The accident had been caused by a fall from a carriage.

In a specimen in my private collection, obtained from the body of an insane woman, upwards of seventy years of age, whose skeleton presented the appearance of having been broken in numerous places, the head of the humerus is completely detached from the anatomical neck, the articulating surface, which retained its smooth and polished aspect, being tilted over the great tuberosity against the posterior surface of the bone, to which it is firmly and inseparably united by osseous matter, the fracture having evidently happened a long time before death. Directly opposite to the prominence thus formed, on the inner surface of the humerus, is another large projection, fully an inch in length, having the character of a stalactitic exostosis. The bicipital groove is completely effaced. The whole bone is extremely light, its weight being hardly two ounces and a half. The annexed cut (fig. 95) conveys a good idea of the distinguishing features of this remarkable, if not unique specimen.

Fig. 95.



When the head of the humerus is completely detached from the tubercles along the anatomical neck, it must necessarily act as a foreign body, speedily perishing from the want of nourishment. In some cases, however, it is enabled to preserve its vitality, although imperfectly, by remaining in connection with the rest of the bone through the intervention of a few bands of fibrous tissue.

Fig. 96.



Fracture of anatomical neck of humerus.

*b. Fracture of the Anatomical Neck.*—In children, prior to the completion of ossification, the head of the humerus is occasionally separated from the shaft of the bone, very near the point of attachment of the capsular ligament, or at the anatomical neck. The accident is generally caused by a fall on the elbow, or by violence applied to the shoulder, and is very liable to be mistaken for other injuries. In old persons, the head of the bone is sometimes not only broken off (fig. 96), but thrown down into the axilla, where it forms a distinct tumor that can easily be felt by the hand, but which does not obey the movements of the arm. Such an accident always seriously complicates the case.

Intra-capsular fracture of the humerus is occasionally *impacted*, the upper fragment being propelled into the inferior. The occurrence, which is extremely uncommon, is met with exclusively in old subjects, laboring under atrophy and great fra-

gility of the osseous tissue. The head of the bone can be felt in the glenoid cavity, there is a slight hollow below the acromion, the axis of the arm is directed inwards towards the coracoid process, and the elbow is somewhat separated from the trunk. Crepitation is either very faint or entirely wanting. The length of the humerus is diminished, but generally in so slight a degree as to render it unavailing in a diagnostic point of view.

*c. Fracture of the Surgical Neck.*—Fracture of this portion of the humerus is uncommon, but may take place from the same causes as fracture of the shaft of the bone; sometimes from a fall upon the hand or elbow, sometimes from direct violence, and sometimes, although rarely, from muscular action. The injury is always attended with marked displacement, forming an important feature in its history. The superior fragment, yielding to the influence of the spinatus muscles of the scapula, is generally drawn outwards and slightly forwards, while the inferior one is directed inwards towards the side of the trunk by

Fig. 97.



the pectoral, broad dorsal, and large teres muscles, attached to the inner border of the bicipital groove. At the same time that this portion of the humerus is dragged inwards, it is usually somewhat raised by the joint agency of the muscles that pass from the scapula to the forearm; the extent of the displacement, however, is commonly trivial, inasmuch as the weight of the limb is almost sufficient to counteract its occurrence.

The *diagnosis* of these different fractures is not always so easy as might, at first, be supposed. Their character is often greatly obscured by the swelling, and the consequent difficulty of making a thorough examination. In general, there is marked deformity at the shoulder-joint, the deltoid muscle is flattened, the arm is twisted upon its axis, and, if the injury is situated on the outside of the capsular ligament, there is usually slight shortening of the humerus, with distinct projection of the upper end of the lower fragment. If extension and counter-extension be made, so as to draw the parts in place, crepitation will be elicited, followed by a recurrence of all the previous symptoms the moment the surgeon relinquishes his hold. In all cases of doubt, it will be a good plan to grasp the head of the humerus firmly with the thumb and fingers of one hand, while with the other we seize the elbow and move the arm on its axis. If fracture be present, it will be almost sure to be detected by the crepitation produced by the manoeuvre, whereas, if there be a dislocation, no noise will be perceived, and there will also be little or no mobility. When the head of the bone is fractured, and thrown off the glenoid cavity, the symptoms will be of a compound character, the crepitation and abnormal mobility co-existing with flattening of the deltoid muscle,



extraordinary saliency of the acromion process, and a remarkable fulness in the axilla, caused by the presence of the displaced bone, at the same time that the upper extremity of the inferior fragment projects prominently upwards and inwards.

*Treatment.*—Fractures of the superior extremity of the humerus must all be treated upon the same general principles as fractures of the shaft of the bone. The limb being bandaged from the fingers up, two splints, broad and hollow, made of unoled sole-leather, binder's board, gutta-percha, or gum sheeting, are applied, one on the outside, and the other on the inside of the limb, the former being long enough to extend from the external condyle to the top of the shoulder, which it should cover well in, since it is of paramount importance to give firm support to the broken parts. The inner splint should be carefully padded at its superior extremity, in order that it may not chafe the skin or exert any disagreeable pressure upon the axillary vessels and nerves. No cushion will be required for the axilla. The arm is carefully secured to the side of the chest, and the forearm is supported in a sling, but the elbow is left free, in the hope that its weight will tend to prevent overlapping of the fragments. Passive motion is instituted at the end of the third week, and firm union may reasonably be expected in a fortnight more. A long time, however, will elapse before the joint will completely regain its functions, if, indeed, it ever do. Permanent lameness will almost be inevitable, if the fracture be intra-capsular and comminuted, owing to the difficulty of readjusting the fragments.

When fracture of the superior extremity of the humerus is complicated with *dislocation*, the proper plan, of course, is to restore the displaced bone to its natural position before an attempt is made to readjust the ends of the fragments. The operation, however, will necessarily be one of extreme difficulty, on account of the shortness of the superior piece, which thus deprives the surgeon of the advantage of a suitable lever. His whole reliance must, therefore, be upon well-directed pressure and counter-pressure, while the patient is fully under the influence of an anæsthetic, complete muscular relaxation being of paramount importance to success. When the operation fails, it has been recommended to let the dislocated head of the bone remain in its unnatural situation, and to bring the upper extremity of the lower fragment in contact with the glenoid cavity, in the hope that, in time, as the bone becomes rounded off, it will contribute to the restoration of the motion of the limb. Such an idea, however, it seems to me, must be perfectly delusive; for it is impossible to see how, under such circumstances, nature could make anything like a good or useful joint. Instead, therefore, of pursuing such a practice, I should not hesitate, if a case of the kind were to present itself to me, to cut down upon the dislocated bone, and push it back into its natural position. The broken pieces being placed in contact, and the wound carefully closed, I should not apprehend any bad results from inflammation and its consequences. Excision of the head of the humerus is seldom followed by serious effects; and, although the two cases are not exactly parallel, yet I should neither expect to lose my patient, nor to make him a stiff joint.

Fractures of the surgical neck of the humerus are occasionally *impacted*, the upper extremity of the inferior fragment being forcibly driven into the cancellated structure of the lower end of the superior fragment. Such an occurrence is most common in old subjects, after the age of fifty-five, in consequence of interstitial absorption of the osseous tissue, and may be produced either by a blow upon the shoulder, or, what is more common, by a fall upon the elbow. The extent of the impaction varies from a few lines to half an inch or more. As the bone retains its continuity, the symptoms of the accident are usually very obscure, there being neither mobility nor crepitation, unless the fragments are unlocked by being forcibly pulled asunder. Nevertheless, there is generally some deformity, perceptible upon firmly grasping the humerus, and an alteration in the axis of the limb, which often looks as if it were twisted, together with severe pain, and usually also more or less contusion of the soft parts. If the impaction be extensive, there will, in addition, be some degree of shortening of the arm, or a slight diminution in the distance between the shoulder and elbow. These circumstances, conjoined with the fact that the patient has received a severe injury, that there is loss of motion in the joint, and that all the symptoms of dislocation are absent, afford sufficient evidence of the probable nature of the case.

The impacted fracture requires no special treatment on its own account. Experience and common sense alike dictate the propriety of letting it alone. Nothing, certainly, can be gained by pulling the fragments forcibly asunder, except mischief and trouble. Instead, then, of such interference, the surgeon contents himself with supporting the limb, and combating inflammation by leeching, fomentations, and other means; taking care, in due time, to institute passive motion, lest anchylosis should arise.

*d. Great Tuberosity.*—Fracture of this portion of the humerus, although uncommon, is probably not quite as infrequent as is generally supposed, the obscurity of its symptoms rendering it extremely apt to be mistaken for other lesions in and around the scapulo-humeral articulation. The accident is liable to occur at almost any period of life, except, perhaps, in early childhood, and is always caused by a fall or blow upon the forepart of the shoulder, the force being concentrated upon the upper extremity of the humerus so as to separate the large tubercle from the hemispherical head and shaft of the bone. The existence of the fracture is denoted by considerable flattening of the deltoid muscle, by a remarkable increase in the width of the upper portion of the arm, which is nearly double what it is in the natural state, and by the presence of two osseous prominences, one of which, consisting of the detached tuberosity, is situated at the superior and outer part of the joint, and the other, formed by the head of the humerus, at the upper and inner part. The acromion is abnormally salient, and the arm is separated from the side, but can be approximated to it without difficulty.

The most important *diagnostic* signs are the great increase in the breadth of the articulation, the refusal of the thumb to sink into the glenoid cavity, as it always does in dislocation of the shoulder, the

preservation of the length of the limb, and the production of crepitation upon rotating the humerus by seizing it just above the elbow while the surgeon encircles the head of the humerus with both hands. Another important evidence is the fact that the deformity is readily effaced by manipulation, but instantly reappears when it ceases.

Reparation, generally of an osseous character, is effected in from four to six weeks, according to the age of the patient, and the amount of the resulting inflammation, which is always very considerable, in consequence of the concomitant contusion of the soft parts. Owing to this circumstance, the motions of the joint usually remain imperfect for many months; and in not a few cases, even when the greatest vigilance is exercised, they are never completely regained, owing to a redundancy of callus and the formation of osseous excrescences around the articular surfaces.

In the *treatment* of this fracture, one of the leading indications is to neutralize the action of the muscles which are attached to the tubercles of the humerus, the larger one receiving the insertion of the two spinate and the small teres, and the lesser the subscapular, which necessarily tend to draw the fragments away from each other, the subscapular being materially aided in this by the action of the broad dorsal, the great pectoral, and the short head of the flexor of the arm. To accomplish this object, the limb is put up in two leather splints, the inner one of which is nicely padded above to prevent undue pressure upon the axillary vessels and nerves, while the outer one should be bent well over the top of the shoulder. No cushion will be necessary, especially if the precaution be used of securing the arm and forearm properly to the chest. The elbow is carefully supported in a sling, but not so firmly as to push the head of the bone too high up towards the acromion process. For the first five or six days after the accident, leeches and fomentations may be required, and passive motion should be instituted in three weeks.

### 3. INFERIOR EXTREMITY.

#### FRACTURES OF THE FOOT.

Fractures of the bones of the foot do not require any special notice, as their management is conducted upon the same principles as that of fractures of the hand. From the fact that they are generally complicated, the treatment must be largely antiphlogistic, and the surgeon will have cause to congratulate himself if he is not occasionally obliged to amputate the foot, or exsect some of its bones.

The *calcaneum*, or heel-bone, notwithstanding its exposed situation, the importance of its functions, and the manner in which it lies beneath the tibia and fibula, is seldom the subject of fracture. Direct violence is the most common cause of the accident, which is often attended with severe lesion of the neighboring structures, both soft and hard. Falling from a great height, in which the person alights upon his heel or foot, is the manner in which it commonly happens. The bone being thus forcibly acted upon, on the one hand, by the weight of the body,



and, on the other, by the resistance offered by the surface struck, yields at its weakest point, breaking perhaps into several pieces. More rarely the accident is produced by the inordinate contraction of the muscles of the calf, as in dancing and leaping; but in this case it is only the posterior extremity of the bone that suffers, its tip being the part generally torn off. The amount of displacement varies according to circumstances, being necessarily very slight when the fracture extends across the body of the bone, whereas it is always very considerable when it involves its back part, on account of the action of the gastrocnemial muscles, which, exerting their influence through the tendo-Achillis, sometimes draw up the posterior fragment from an inch and a half to two inches. Authors speak of an impacted fracture of the calcaneum, but the possibility of such an occurrence is questionable.

The *signs* of this fracture are always sufficiently characteristic when the posterior portion of the bone is broken off, the hollow at the heel, the protuberance at the lower and back part of the leg, and the impossibility of extending the foot, being unmistakable evidences of the nature of the accident. Upon bringing down the upper fragment in contact with the inferior, crepitus may be obtained, though it will be very faint if the tip only of the bone has been detached. The diagnosis will be more difficult when the fracture extends across the body of the calcaneum; for then there will be no displacement, the lateral and interosseous ligaments keeping the posterior fragment in position. In general, however, it may be determined by the history of the case, and by making pressure upon the calcaneum in different directions, thus eliciting crepitation if fracture actually exist.

A fracture of the calcaneum from the laceration of its fibres is usually slow in *uniting* on account of the difficulty of keeping the fragments in contact, the muscles of the calf constantly tending to separate the upper from the lower. For this reason, the union will frequently, if not generally, be ligamentous instead of osseous, and a long time will, therefore, be required for the complete restoration of the functions of the foot. When the fracture is caused by direct violence, the repair is effected in the ordinary manner.

When there is much contusion of the soft parts, it may be necessary to use antiphlogistics for moderating the inflammation, before applying permanent *dressings*. The nature of these dressings must depend upon the presence or absence of displacement. In the former case, the chief obstacle to the cure is the contraction of the gastrocnemial muscles, which must, therefore, be effectually controlled until the consolidation has advanced sufficiently to enable the upper fragment to maintain its position independently of extrinsic aid. The least objectionable contrivance for fulfilling this indication is a short splint, of stout tin, well padded, and adapted to the shape of the limb, the anterior part of which it should cover from the middle of the leg as far nearly as the toes. When tin cannot be obtained, wood, sole-leather, or binder's board, may be used. The object of this splint is to maintain the leg and foot in a permanently extended position, for in proportion as this is effected will be the relaxation of the muscles of the calf. To maintain the upper fragment in place, the leg and foot may

be bandaged in opposite directions, adhesive strips and a compress having previously been applied around the heel and sole. This position should be continued for at least six weeks, or until there is reason to believe that the connecting medium is firmly established. The apparatus of Petit, formerly so popular in the treatment of this form of fracture, should not be used, as it is anything but a suitable contrivance, the tendency of the cord and slipper being to displace the upper fragment, and to irritate the soft parts about the heel.

In the other variety of fracture, as there is no displacement, all that is necessary is to subdue inflammatory action, and to keep the foot and leg in a quiet and relaxed position with a tin-case, or two light side splints, the limb lying upon its outer surface over a pillow.

#### FRACTURES OF THE TIBIA.

The tibia, like other long bones, is liable to give way at various points of its extent, but more frequently below its middle than anywhere else. A fracture of its condyles is unusual, and its occurrence is always denotive of great direct violence. Occasionally the bone is broken near its upper extremity, from an inch to an inch and a half below the knee. The external malleolus is sometimes detached by a twist of the foot, by a fall upon the sole of the foot, or by direct injury.

Most fractures of the shaft of the tibia are oblique, very few, if any, transverse; nevertheless, as the fibula retains its integrity, there is seldom any considerable displacement, the sound bone acting as a splint to the broken one. It is not often, however, that the fragments completely retain their apposition; in general, there is some degree of separation, which may always be easily detected, even when there is considerable tumefaction, by passing the finger along the tibia, and tracing its outline. If there be a fracture, it will manifest itself by an abnormal depression at some particular point, or by an unnatural projection, sufficiently obvious to establish at once the nature of the case. The amount of this projection is often very great, especially when the upper fragment is very long, sharp, and oblique, in which case it is generally extremely prominent, and with difficulty prevented from piercing the skin. The annexed drawing (fig. 98), from a preparation in my collection, conveys a good idea of this form of injury. For the reason just mentioned, there will usually be an absence of crepitation, or if there be any evidence of this kind, it will be very faint and unsatisfactory. The fracture, if perfectly free from complication, will commonly unite in from four and a half to five weeks.

Fracture of the internal malleolus is met with in various forms. In some cases, it is broken off at, or

Fig. 98.



close to, its connection with the lower end of the tibia; in others, near its free extremity; but the most common site of the lesion is about the centre of the process. Its direction is nearly always oblique; rarely, if ever, strictly transverse or perpendicular. Occasionally the process is broken at several points, thus constituting a comminuted fracture. Finally, cases occur, although rarely, in which the fracture co-exists with fracture of the lower extremity of the fibula. The diagnosis is easily established by the position of the foot, which is always turned upwards and inwards, as if it were partially dislocated; and by the facility with which the detached piece of bone can be moved about with the thumb and finger; a procedure which also readily elicits crepitation.

The most simple contrivance for the *treatment* of fracture of the tibia, is a tin-case (fig. 99), accurately shaped to the limb, provided with a foot-piece, and reaching a few inches above the knee. A bandage is applied in the usual manner, and any tendency to displacement is easily counteracted by means of a compress, arranged so as to bear gently and equably upon the ends of the fragments. I have never found it necessary to employ any other apparatus than this, no matter where the tibia has been broken. When the fracture involves the malleolus the foot-piece will effectually prevent displacement. In fracture of

Fig. 99.

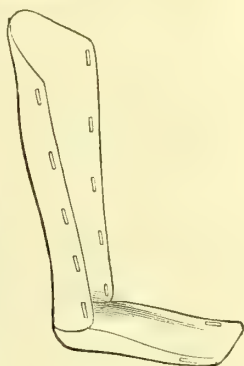


Fig. 100.

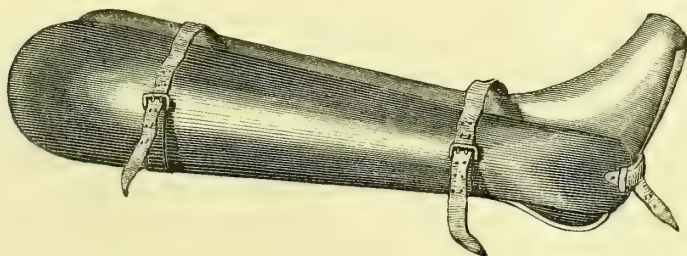
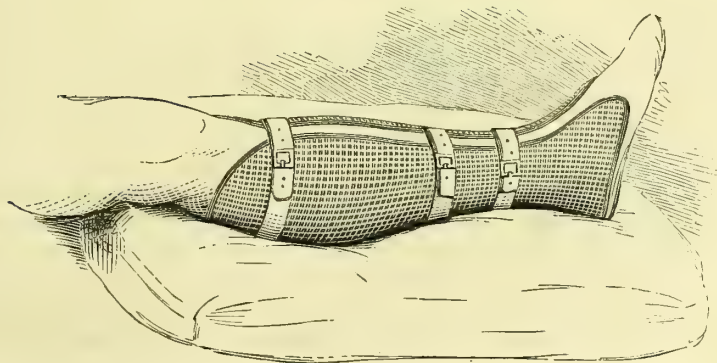


Fig. 101.





the superior extremity of the tibia, extending into the condyles, the plan usually adopted is to place the leg and thigh in the straight position, so as to compel the condyles of the femur to support the broken bone, extension and counter-extension being made with two long splints. Such a contrivance, however, will be altogether unnecessary, if we employ the tin-case, especially if it be made sufficiently long to embrace the inferior third of the thigh, thereby completely counteracting any tendency on the part of the muscles of the limb to draw the upper fragment backwards into the popliteal space. An efficient apparatus for these fractures will also be found in Dr. Welch's splints (fig. 100); and in the wire splints of Dr. Bauer (fig. 101), the latter being particularly valuable on account of their light, airy, and pliable character.

#### FRACTURES OF THE FIBULA.

Fracture of the fibula is, relatively considered, a sufficiently common occurrence, its frequency being due apparently to the slender form of this bone, to its superficial situation, and, above all, to the important part which it plays in the formation of the ankle-joint. The accident may take place at any portion of the bone, but is most common, by far, in the inferior fifth of its extent, owing to its intimate connection with the astragalus, which, constituting the pivot of the foot, readily receives and transmits the various shocks to which the latter is so continually exposed. Of fractures of the shaft and head of the fibula, no particular description is necessary, since they are always easy of detection, and since the treatment does not differ materially from that of similar injuries of the tibia. But it is different with fractures of the inferior fifth of the bone, where, as just stated, the lesion is most common, and where, from being usually associated with other mischief, it is extremely liable to be followed by deformity and permanent lameness. For these reasons, fractures in this situation require to be studied with more than ordinary care.

Fractures of the fibula are much more common on the right side than on the left. In 207 cases, collected by Dupuytren, more than two-thirds involved the right leg. The statistics of Malgaigne show that it is most frequently met with between the ages of twenty-five and fifty, and that men are more than four times as liable to it as women. Of 104 cases examined by this author, not a single one occurred before the fifteenth year.

The *causes* of fractures of this portion of the fibula can be properly appreciated only by a careful examination of their mechanism. The tibio-tarsal articulation being a hinge-joint, admits chiefly of flexion and extension, its lateral movements being restrained by the two malleoli, and the ligaments by which the bones of the leg are connected with those of the foot. Hence, the latter cannot be turned outwards or inwards to any considerable extent without producing a fracture of the former, the site of injury being determined by the particular inclination of the limb. Thus, when the foot is forcibly abducted, its inner edge resting on the ground, the upper surface of the calcaneum will be pressed violently against the external malleolus,

in a direction parallel to the fibula, which will, consequently, yield at its weakest point, which is about an inch and a half above the joint, at the part sometimes called the neck of the bone. In most cases there is a rupture of the deltoid ligament, if not also a fracture of the internal malleolus. When the foot is forcibly adducted, the astragalus becomes the immediate cause of fracture, for this bone, turning upon its antero-posterior axis, escapes from the arched cavity formed by the tibia and fibula, and pressing against the outer malleolus, breaks the fibula nearly at the same level as in the preceding case, the direction of the fissure being usually somewhat oblique. The external lateral ligament is either torn or violently stretched.

The most ordinary cause of this fracture is a fall upon the foot, in which this portion of the limb is forcibly inclined laterally, at the moment the weight of the body impels the bones of the leg forcibly against those of the foot, rendered stationary by the resistance offered by the ground. The fibula may also be broken across by violence applied directly to the part, as a blow, or the passage of the wheel of a carriage.

However the fracture may be induced, the superior extremity of the inferior fragment is always thrust inwards against the tibia, while the inferior extremity of the superior fragment either remains fixed, or inclines in the same direction. The latter usually happens when the injury is direct, the former when it is indirect.

The inferior extremity of the fibula is sometimes broken almost vertically; such an occurrence, however, must be extremely uncommon, and I have seen but two instances of it, both of them being specimens in Dr. Mütter's collection. In one, represented in the annexed sketch (fig. 102), the bone looks as if it had been split, the fissure extending upwards, almost in a straight line, fully an inch and a half, the posterior, longer, and larger fragment being pushed considerably backwards, so as to form with the other an intermediate triangular space. In the other bone the fracture is also vertical, but the separation is much less.

The *symptoms* of fracture of the lower extremity of the fibula vary according to the circumstances of the case. When this bone alone is severed, the chief signs will be slight eversion of the foot, a depression at the site of injury, and some change, usually not very conspicuous, in the contour of the ankle-joint. When the internal malleolus is broken off, or when the tibia has given way a short distance above the articulation, these characters will exist in a more marked degree, and point out unerringly the nature of the lesion. The foot will be so much abducted as to present the appearance of being dislocated outwardly; the width between the two malleoli will be much increased; the hollow at the line of fracture will be quite deep; and the external margin of the foot will be considerably elevated, while the internal will be proportionably depressed. Upon taking hold of the foot, it will be found that it is unusually movable, and that it can easily be restored to its natural relations, but that the moment we cease our

Fig. 102.

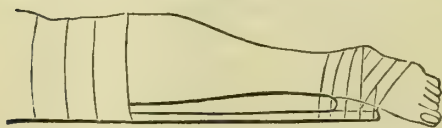


grasp it will return to its former position. In performing these manipulations crepitus is very easily felt; and, upon tracing the outline of the lower portion of the bone, the finger will usually sink in at the seat of fracture, owing to the fact, previously mentioned, that the upper end of the lower fragment always falls over towards the tibia. A good deal of ecchymosis is often present, and a considerable amount of swelling quickly follows, obscuring the characteristic features of the injury, and embarrassing the diagnosis. The only accident with which fracture of the inferior extremity of the fibula is liable to be confounded is a sprain of the ankle-joint, from which, however, it may always readily be distinguished by the great distortion which attends it, and by the presence of crepitus.

A simple fracture of the fibula in the inferior-fifth of its extent will, if properly treated, usually unite in a month, without any deformity of the limb, although even then a considerable time will elapse before the ankle-joint will perfectly regain its functions. When the injury is complicated with rupture of the ligaments, fracture of the corresponding portion of the tibia, or other serious lesion, the repair will be much slower, and there will be danger, unless the case is managed with the most consummate skill, of permanent deformity and lameness, the former manifesting itself in an everted condition of the foot and in increased width of the ankle-joint.

The material point in the *treatment* of fracture of the fibula in this situation is to maintain the foot in a position the reverse of that which it assumes in consequence of the injury. To accomplish this object, which is designed to draw away the upper extremity of the lower fragment from the tibia, and to restore it to its proper relations, the limb, after having been enveloped in the ordinary bandage, with the precaution of not compressing it opposite the site of fracture, is placed in a tin-case, the foot being directed permanently inwards. The requisite inclination may easily be imparted by means of a piece of roller, or a few adhesive strips, carried around the instep and heel, and attached to the inside of the leg. Or, instead of this, the fracture may be treated with Dupuytren's apparatus (fig. 103), consisting of a light

Fig. 103.



wooden splint and a wedge-shaped cushion; the former reaching from the upper third of the leg to about three inches below the sole of the foot, and the latter from the same point to a level with the ankle. The limb being bandaged in the

same cautious manner as in the former case, the apparatus is stretched along its inner surface with the tapering end of the pad upwards, and secured, first above, and then below, the roller being passed around the foot and ankle in such a manner as to turn the internal margin of the foot upwards and inwards. The limb may afterwards be kept in the extended position, or, what is preferable, be placed, half bent, upon its outer surface over a large pillow. The parts are diligently watched, the dressing being changed as occasion may seem to require, and passive motion instituted at the end of the third week.



## FRACTURES OF BOTH THE TIBIA AND FIBULA.

Fractures of both bones of the leg are sufficiently common, particularly in young and middle-aged subjects, and are deserving of special attention, on account of the difficulty of their management, and their liability to be followed by deformity and lameness.

Much diversity obtains in regard to the *seat* of these fractures, as well as concerning their direction, and the nature and extent of their displacement. In twenty-two specimens, contained in Dr. Mütter's collection and my own, I find that in ten the tibia and fibula were broken at their inferior extremity, the line of separation in none of them extending beyond three inches above the joint. In four the tibia gave way at its lower third, and the fibula at from two to three inches and a half from its head, or junction with the upper end of the tibia. In six of the cases the tibia was broken from two to three inches above its inferior articulating surface; in two of these the fibula had yielded at its middle, and in the remaining four at different points of its extent. In only two cases had both bones been broken at the same level; in one of these the fracture occurred at the middle of these pieces, and in the other a little below that place.

In the twenty-two cases the tibia had been broken only twice above its middle; whereas, the fibula had given way above this situation in six cases. In sixteen of the cases the seat of fracture of the tibia was either at the ankle-joint, or below the middle of the bone, generally in its inferior fourth or third. In ten cases of fracture of the fibula the seat of the injury was either at the joint, or within the first three inches from its articulating extremity.

From the above examinations it follows: first, that the tibia and fibula rarely break on the same level; secondly, that both bones are most liable to yield either at the ankle-joint, or, at all events, within the first three inches above that joint; and thirdly, that the fibula is more frequently fractured at its superior extremity than the tibia.

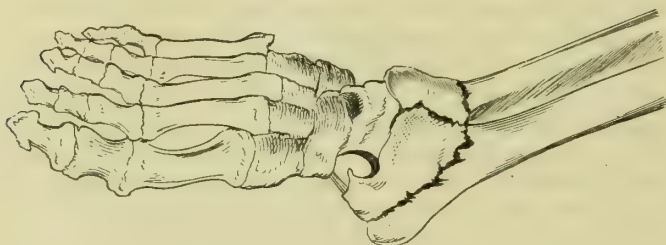
An examination of these specimens has supplied me with some other interesting facts. Thus, I have found that the fracture in nearly all was more or less oblique, the line of separation in fifteen specimens of broken tibia extending from above downwards, and from without inwards. As a natural consequence of this occurrence, the superior extremity of the inferior fragment projected outwards towards the fibula, which it touched in several of the preparations, on account of a want of proper adjustment during the treatment; the lower extremity of the upper fragment, on the contrary, projected inwards, and had apparently generally been much the sharper of the two. The fibula, in most of the specimens, afforded evidence of having been broken across more abruptly than the tibia, but still with a considerable degree of obliquity in almost every instance that I inspected.

In recent fracture of the tibia, complicated with fracture of the fibula, the inferior extremity of the upper fragment is generally remarkably sharp, and, in consequence, often protrudes through the integuments at the time of the injury, the same cause that produces the

lesion forcing it across the soft parts. Or, if it is not pushed out at the moment of the accident, it often escapes afterwards, through ulceration, induced by the pressure which it exerts upon the soft parts. The obliquity of fractures of the tibia is often very extraordinary, and there are few cases in which it does not become a source of great suffering to the patient, and of annoyance to the surgeon, on account of the trouble that is experienced in keeping the fragments in their proper relations.

A rare form of fracture of these two bones is represented in the annexed drawing (fig. 104), from a specimen in my collection. The tibia,

Fig. 104.



it will be perceived, is broken off just above its articulating surface without affecting the internal malleolus, while the fibula has given away about an inch and a quarter above the joint. The foot is characteristically everted. In fig. 105, also from a specimen in my possession, the fracture embraces both the extremity and the malleolus of the tibia; the fibula being broken off a few lines above the joint. Fig.

Fig. 105.

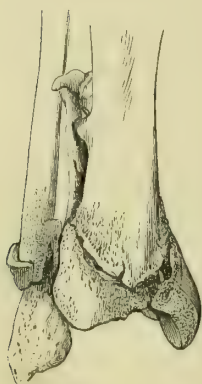
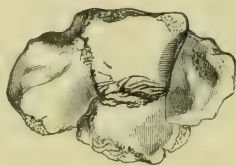


Fig. 106.



106 exhibits the appearance of the broken articulating surface of the tibia.

The *causes* of fractures of both bones of the leg are either direct or indirect, just as when these pieces suffer separately. A very common mode in which the accident happens is a fall upon the pavement, as when an individual slips in consequence of the presence of ice, or when, as he is rapidly walking, the foot is suddenly caught in a hollow, or between two hard resisting objects, so as to throw the whole weight of the body upon the leg. Another way in which the lesion is produced is a fall from a considerable height, as when a person is precipitated from a scaffolding. Jumping out of a carriage under full speed often produces frac-

ture of the tibia and fibula. In many cases, the injury is occasioned by direct violence, as by the passage of the wheel of a carriage, the kick of a horse, the caving in of a sand bank, or the fall of a heavy stone.

In whatever manner the injury is induced, the *symptoms* are generally well marked, if not positively unmistakable. In nearly every case the limb is shortened from one and a half to three inches, and there is also, generally, great deformity in its diameter, both depending upon the overlapping of the fragments, which, as already stated, is frequently very extraordinary. Besides, upon making extension and counter-extension, it is generally easy to elicit crepitation. When the fracture is very oblique, the lower end of the superior fragment may usually be felt immediately beneath the integuments, forming a sharp, prominent projection in front of the limb, or at its inner aspect. Sometimes the soft structures are much bruised and ecchymosed. Another remarkable symptom, one which, indeed, is seldom absent, is a spasmodic twitching of the limb, coming on soon after the accident, and frequently lasting for several weeks, much to the annoyance and distress of the patient.

When the fracture is situated just above the ankle, the foot will usually be a good deal everted, causing an appearance of dislocation outwards, as exhibited in the adjoining cut (fig. 107).

The *prognosis* of fracture of both bones of the leg may be gathered, in part, from what precedes. In the more simple forms of the injury, attended with but little obliquity, a good cure can generally be effected in from four to five weeks. If, however, the obliquity is uncommonly great, it will be found extremely difficult, if not impossible, to effect consolidation in a manner altogether unexceptionable, however skilfully and zealously the treatment may be conducted. More or less deformity will almost be inevitable, either in the length or in the diameter of the limb; owing to the remarkable tendency which the ends of the fragments have to overlap each other, and which it is often impossible to counteract successfully whatever means may be adopted for the purpose.

Old fractures of the tibia and fibula, like those of the bones of the forearm, are occasionally connected by a bridge of callus, or of new osseous matter, which does not, however, so far as can be determined, impair their usefulness, as must always necessarily be the case with the latter. I have several times met with this occurrence when the lesion was confined to one of these bones, and I am not able to say whether one is more liable to give rise to it than the other. Moreover, it does not seem to be necessary to its production that there should be any approximation of the ends of the opposite fragments, as it may

Fig. 107.



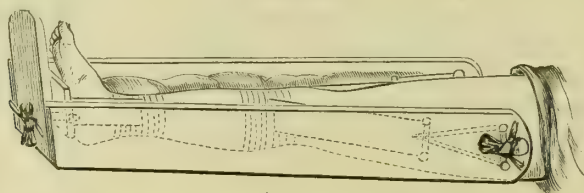


take place when they are perfectly straight, although the former condition no doubt acts as a predisposing cause.

Fractures of both bones of the leg, if attended with shortening of the limb, require to be treated by extension and counter-extension, steadily and persistently maintained throughout, otherwise, as just stated, deformity will almost be inevitable. If, on the other hand, the fracture be transverse, or nearly so, such a procedure may of course be dispensed with, the object being attained by confining the leg in a tin-case, or fracture box, care being taken to keep the great toe constantly on a line with the inner border of the patella, the surest evidence that there is no rotation of the ends of the fragments upon each other. Any tendency to forward, backward, or lateral displacement is generally easily counteracted by means of compresses and short splints. The limb may then be placed in an easy position upon a slightly inclined plane, made of a bolster or pillow, or it may be suspended by a cord and pulley to the tester of the bed, as may be found most agreeable, or convenient.

Counter-extension may be made, when the fracture is oblique, by means of a box provided with a foot-board, and two lateral splints, one extending to the perineum, and the other to the axilla, as I have generally myself preferred; or with the contrivance of Dr. Neill, consisting of a box, reaching as high as the middle of the thigh, the

Fig. 108.



Neill's apparatus for fracture of the leg.

counter-extension being made with adhesive strips, passed through holes at the upper part of the apparatus, and tied on the outside (fig. 108).

The use of the gaiter (fig. 109), in the treatment of fractures of the leg and thigh, attended with shortening and deformity, cannot be too pointedly condemned, as it is almost impossible, in any case, however

Fig. 109.

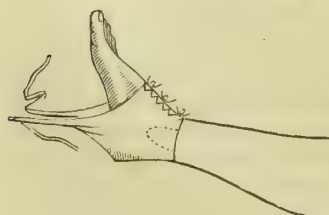
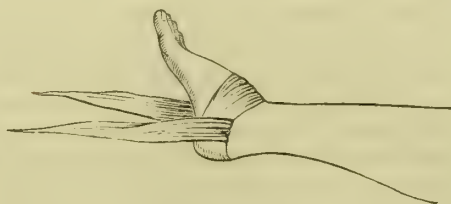


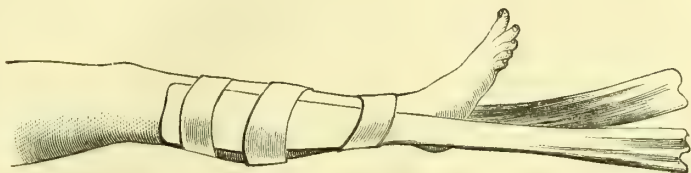
Fig. 110.



carefully watched, to prevent chafing and other inconvenience. A similar remark is applicable, only more forcibly, to the handkerchief

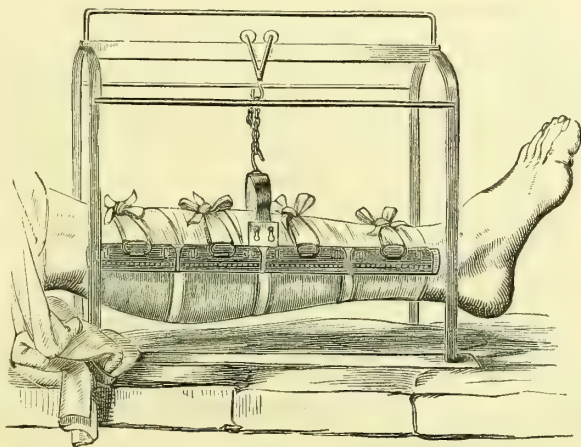
(fig. 110), at one time so much employed for this purpose. Both appliances are most villanous, and should therefore be proscribed, especially as an admirable substitute may always be found in the adhesive strips, secured to the sides of the limb (fig. 111), and tied at the bottom of the foot-board.

Fig. 111.



Suspension of the leg may sometimes be advantageously practised, both as it respects the comfort of the patient and the welfare of the fracture. It may be done according to the method recommended many years ago by Professor Smith, of Baltimore, or the very simple contrivance of Mr. Salter, of England, depicted in the adjoining sketch (fig. 112), representing the limb surrounded by the apparatus,

Fig. 112.



Salter's apparatus for suspending the leg.

and slung to the tester of the bed. The case in which the leg rests is made of light metal; and the whole contrivance is so arranged as to admit of lateral motion, and also of sliding up and down, simply by the rolling of the pulley-wheels upon the horizontal bar.

The apparatus of Dr. Smith may be used for fractures of any of the long bones of the lower extremity, whether simple, compound, or complicated. It consists of two pieces, united by a hinge, after the fashion of a double inclined plane, one corresponding with the thigh, and the other with the leg, the latter supporting a shoe, which is attached by a thumb screw, and is so arranged as to be rotated outwards or inwards, thereby elevating or depressing the toe, as may be

deemed most desirable. The two pieces are supplied with side boards, joined by bows of iron beneath; and they are so constructed, both at the knee and at the foot, that they may be elongated or shortened at pleasure. Moreover, a short crutch, movable and well padded, is secured to the inner and upper extremity of the thigh portion, in order to prevent injurious pressure upon the perineum. Another piece, well padded, movable, and composed of iron, is appended to the superior and outer part of the apparatus, and is fastened round the trunk by a strong band. The thigh and leg rest on slings attached to the side-pieces, the latter being confined in the apparatus by its own weight, aided by a bandage, while the former is supported in front by a well padded, flexible splint. The whole contrivance is suspended to the ceiling, or the tester of the bed, by a single cord, attached below the knee, near the centre of gravity of the limb and apparatus. The cord ascends with a slight obliquity from the trunk, so as to effect the requisite extension, by making gentle traction on the limb, which is completely grasped by the apparatus, and consequently firmly held by it. In this manner, the member is compelled to obey all the accidental and necessary movements of the body, thus obviating all strain and tension at the seat of fracture.

#### COMPLICATED FRACTURES OF THE LEG.

Fractures of the leg are not unfrequently complicated, whether involving both bones or only one (fig. 113). In the latter case, the tibia, much more frequently than the fibula, is the piece that is most liable to suffer.

Fig. 113.



Complicated fracture of the leg.

Such accidents are produced in various ways; sometimes by violence applied to the foot, as when a man jumps out of a second story window, or falls from a scaffolding; but more generally by direct force, as the passage of the wheel of a carriage, a blow from a stone, or the kick of a horse. When produced by these and other similar causes, the lesion is usually situated in the inferior portion of the leg, towards the ankle-joint, which is not unfrequently penetrated. Fractures of the leg, occasioned by railway violence, are always of a comminuted character, the bones being extensively crushed, and the soft parts severely lacerated.



rated and contused, if not actually pulpified. Hemorrhage, both venous and arterial, often sadly complicates such injuries, and, along with the shock, sometimes proves speedily fatal, the system, perhaps, never fairly reacting after the accident. Complicated fractures of the leg, of a very bad character, are also frequently produced by machinery in rapid motion, and by gunshot violence. Sometimes, again, especially when there is unusual brittleness of the osseous tissue, the bones are frightfully broken by causes so trivial as to surprise us how they could have induced such a result.

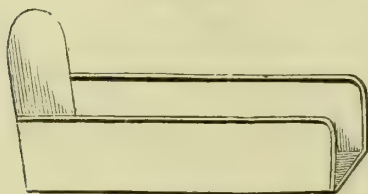
In whatever manner complicated fractures of the leg may happen, the ends of the fragments, particularly those of the tibia, are extremely liable to protrude at the wound; the latter often in such a manner as to render it very difficult to effect replacement, owing to its being tightly girt by the edges of the opening in the integuments, and also to the great length which so frequently distinguishes it. The symptoms of such accidents are always sufficiently characteristic, since there is usually not only great deformity, but likewise, as just stated, exposure of the ends of the broken pieces. Nevertheless, although no difficulty can attend the diagnosis, under such circumstances, so far as the existence of fracture is concerned, yet the surgeon should always institute a most careful and searching examination, with a view of ascertaining the real condition of the soft structures, the welfare of which is often much more deeply interested than that of the bones themselves. The first object, in every case of the kind, should be to determine what should be done; whether an attempt should be made to save the limb or to cut it off. As a general rule, it may be stated that when—if I may use an antithetical and apparently contradictory expression—the complicated fracture is simple, that is, without any serious lesion of the soft parts, an effort should always be made to preserve the limb, especially if the patient be young and robust, and the bone not comminuted, although perhaps broken at several different points. It is true, such cases sometimes terminate unfavorably, both as it respects limb and life; and it should also be borne in mind that the injury sustained both by the soft and the osseous tissues may be much greater and more serious than the eye and hand can possibly detect. The dangers, too, from tetanus, secondary hemorrhage, and profuse and exhausting suppuration, are not to be overlooked by the surgeon in his laudable endeavors to save a patient from mutilation; nor is he to forget that such lesions, especially when seated near the ankle-joint, are extremely liable to be followed by ankylosis.

When the bones are severely comminuted, the soft parts terribly lacerated, or the ankle-joint extensively opened; in short, when the limb has been frightfully bruised, torn, and crushed, no one would hesitate to use the knife the moment sufficient reaction has taken place to enable the system to withstand the additional shock. The case even then is frequently a bad one, the patient often rapidly sinking from exhaustion, or soon after from the effects of pyemia.

When an attempt is made to preserve the limb, the first indication is to arrest hemorrhage; the second, to coaptate the ends of the broken bone; the third, to place the limb in an easy, comfortable, retentive apparatus;

and the fourth, to moderate the resulting inflammation. These intentions are to be fulfilled in conformity with the general principles laid down under the head of general observations on fractures. If the ends of the fragments are unusually long and sharp, and disposed to protrude despite of the ordinary precautions, the best plan will be to retrench them; being careful, however, to cut off as little as possible. The edges of the wound are accurately approximated by suture and collodion, every precaution being used to exclude the atmosphere. The best fracture apparatus is the wooden box (fig. 114), so much used in this city,

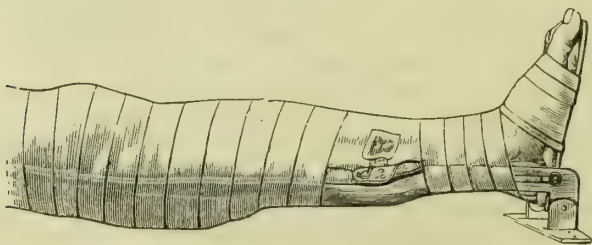
Fig. 114.



both in private and hospital practice, consisting of four pieces, one corresponding with the back of the leg, and two with its sides, the fourth being intended for the foot. The latter, projecting nearly perpendicularly, is provided with two mortise holes, for the reception of the extending bands. The two lateral pieces are secured each by two hinges to the back board,

so as to admit of being opened or shut at pleasure during the application and removal of the dressings. The limb, enveloped in the bandage of Scultetus, is carefully laid into the box, previously closed, and partially filled with coarse bran, which is afterwards piled on until the whole leg and the spaces on each side of it are completely covered in. The advantage of the bran, thus used, is that it affords not only easy, equable, and comfortable support to the broken bones, but also that it readily absorbs the discharges, and prevents the deposit of the ova of the fly, so common during the hot months of this and other countries. Substitution is effected whenever the substance becomes soiled and caked. For a knowledge of this mode of treating compound fractures of the leg, the profession is indebted to Dr. John Rhea Barton, and there is no question that it is one of the most valuable improvements that have been introduced into the management of this class of injuries at the present day, whether it be viewed merely with reference to the comfort of the patient, the safety of the limb, or the convenience of the surgeon.

Fig. 115.



The necessary extension and counter-extension are easily effected by adhesive strips. For the first week or ten days, leeches and cold water-dressing will generally be required. Should suppuration arise, the most soothing application will be a linseed poultice.

A very common mode of dressing compound fractures of the tibia alone, is by M'Intyre's screw splint (fig. 115), well padded, and extended; an opening being left in the bandage opposite the wound.

## FRACTURES OF THE PATELLA.

Fracture of the patella, although comparatively an uncommon event, is of great practical importance, from its proximity to the knee-joint, and the imperfect manner in which it is usually repaired. It may extend through the bone in any direction, transversely, obliquely, or vertically, the frequency of the occurrence being in the order here stated (fig. 116). When the fracture is comminuted, the fissures often exhibit the most irregular arrangement. The causes of the accident are two, external violence, and muscular action. The transverse fracture is nearly always produced by the latter, while the oblique and vertical are the result of direct injury, as a fall, blow, or

kick. In the latter case, consequently, there is frequently severe contusion of the soft parts, and sometimes the knee-joint is even laid open. The transverse fracture is produced by falls in which the leg is strongly flexed upon the thigh, while the body is thrown suddenly and forcibly backwards, thereby putting the extensor muscles powerfully upon the stretch, the line of fracture usually taking place just above the middle of the bone. Jumping out of a carriage, and falling backwards upon the ground, is one of the most common ways in which the accident is occasioned. Circus-riders and ballet-dancers sometimes break this bone in the act of leaping in the exercise of their profession. In transverse fracture, the nature of the accident is at once detectable by the change in the contour of the knee, by the inability to extend the limb, and by the displacement of the upper fragment (fig. 118). In many cases, the person is conscious, at the moment of the accident, of something having given way, and perhaps he may have even heard the peculiar characteristic snap. If he attempts to get up and walk, he will be almost sure to fall, from his inability to extend the leg and support the weight of the body upon it. The displacement is usually considerable, the superior fragment being drawn upwards upon the fore part of the thigh by the extensor muscles. The height to which it may be carried varies according to the extent of the destruction of the ligamentous connection of the tendon of these muscles. When the separation is complete, it may amount to

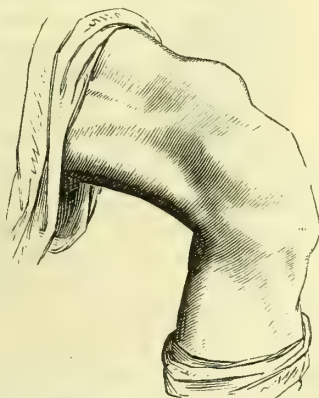
Fig. 116.



Fig. 117.



Fig. 118.



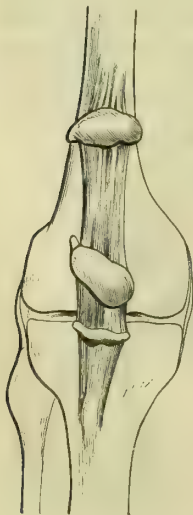


two and a half, three, and even four inches, while under opposite circumstances it may not exceed six, eight, or ten lines. The distance between the two fragments is always increased by bending the leg. The front of the knee has a flattened appearance, and upon passing the finger over it its point will be found to sink down abruptly as it were into the joint. The lower fragment is stationary, but the upper is easily moved, and may, by thorough extension of the limb, be brought down into its normal situation, so as to enable us to detect crepitus. If some time has elapsed since the occurrence of the accident, considerable swelling may be present, obscuring somewhat the diagnosis.

In respect to its mode of *union*, the transverse fracture of the patella holds the same relation as a similar injury of the olecranon. In both cases the nutrition of the fragments is seriously impaired by the laceration of the vessels, and in both great difficulty is experienced in maintaining coaptation. Hence it is a law that the union takes place by ligament and not by bone. In all the cases of this fracture that I have been able to examine, both in the living subject and in museums, I have not met with any where the consolidation was completely osseous. A few such cases, however, have been described by surgeons. In the inferior animals, it is not uncommon, if care be taken to keep the ends of the bone accurately in contact. When the interval between the broken pieces is very considerable, as, for example, when it amounts to two inches, the union is established by the aponeurotic tissue which naturally covers the patella, and which, in this case, extends from one fragment to the other, the plastic matter which is poured out in consequence of the injury not being capable of becoming organized and converted into ligamentous matter. Whatever may be the nature of the connecting medium, it is important that it should be as close and perfect as possible;

for it is found that the joint will always be weak and unprotected precisely in proportion to its length and thinness.

Fig. 119.

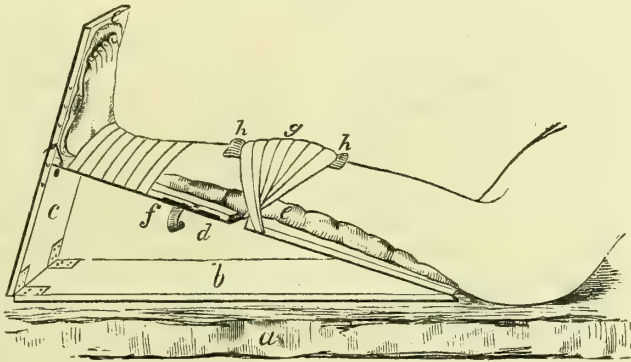


The annexed cut (fig. 119) represents a sketch from a specimen of fracture of this bone in the cabinet of Professor Pancoast. It will be seen that the patella is broken into three pieces, the superior one being drawn up in front of the thigh, far away from the joint, and nearly four inches from the inferior, which consists of a mere little strip, hardly two lines in width, corresponding with the lower edge of the bone. No union followed, owing, doubtless, to bad management or neglect, and the consequence must have been a very imperfect use of the limb.

The *treatment* of transverse fracture of the patella is attended with serious difficulty on account of the trouble which is experienced in controlling the action of the extensor muscles, whose tendency it is constantly to draw the superior fragment upwards away from the lower. To counteract this tendency,

therefore, constitutes the chief indication of the treatment. This can be effected only by maintaining the leg steadily and faithfully in a complete state of extension, the thigh being at the same time flexed upon the pelvis, and the body kept in the semi-erect posture. In this manner, the extensor muscles are thoroughly and effectually relaxed. The most efficient contrivance for insuring this position of the limb is a strong, well padded tin-case, long enough to reach from the middle of the thigh to the corresponding point of the leg, a roller having been previously applied from the toes upwards, and another from the groin downwards. The superior fragment having been brought into place, is next confined by numerous adhesive strips, carried around the bone above and below the joint, and connected afterwards by vertical and transverse pieces. The dressing is completed by the application of a long, thick, and rather narrow compress, extended around the upper border of the patella, and confined by the two rollers passed around the joint in the form of the figure 8. Managed in this way, it is hardly possible for the fracture to suffer the slightest displacement, or to conceive of anything better calculated to fulfil the end in view. The tin-case maintains the limb in the extended position, the adhesive strips and compress retain the upper fragment in contact with the lower, and the two rollers, applied in opposite directions, aid powerfully in controlling muscular contraction. When a suitable case cannot be procured, the object may be attained by the use of a wooden splint, well-padded, and stretched along the posterior part of the thigh and leg. The adjoining drawing (fig. 120) represents the mode of dressing transverse fractures of the patella, pursued by Professor Hamilton, and also, with slight

Fig. 120.



modifications, at the Pennsylvania Hospital, under the care of Dr. Neill and his colleagues. The plan is an excellent one, and seldom fails to effect a good cure; often with hardly any interspace between the ends of the fragments. The letters require brief explanation: *a*, is the bed; *b*, floor of the splint; *c*, foot-piece, provided with holes and side-pins; *d*, inclined plane, constructed so that it may be raised or lowered at pleasure; *e*, cushion, thicker under the knee than at either end; *f*, roller, not completely applied, to secure the limb to the inclined plane; *g*, adhesive strips, laid over a compress, and crossed under the splint,

those from above passing through a notch in the board behind the knee; *h, h*, ends of the compress.

As ankylosis is one of the occurrences most to be dreaded after this fracture, passive motion should be employed as soon as there is reason to believe that the union is sufficiently advanced to admit of it. This will usually be by the end of the third week. It should afterwards be repeated, at first every other day, and then every day, until all risk of this accident is passed. The limb must not be used for the ordinary purposes of progression for three or four months, experience having shown that, if it be exercised too early, the connecting bond will become gradually more and more elongated, and thus materially interfere with the restoration of the functions of the joint. At the expiration of four weeks, the tin-case may be taken off, and a leather splint substituted, the patient walking about upon crutches.

A portion of the patella may be broken off obliquely, and suffering no material displacement, may readily unite by bony matter, as any other fracture. A similar result generally follows when the fissure is *vertical*, with little or no separation of the fragments, the tendency to which is very slight, as the broken pieces are not influenced by muscular contraction. The prognosis is, therefore, other things being equal, always favorable, although, owing to the proximity of the knee-joint, a considerable period will usually elapse before there will be perfect restoration of the functions of the limb.

The signs of these fractures are sometimes very obscure, especially if there be much swelling of the soft parts. In general, however, the nature of the case may be determined by the impaired motion of the knee-joint, by the fixed character of the pain, and by making pressure upon the patella in opposite directions.

The limb, having been enveloped in a bandage, should be kept at rest in an elevated and extended position until there is a complete subsidence of inflammation, when the starch dressing should be applied, the patient being permitted to move about upon crutches. If the fracture be vertical, or nearly so, it will be necessary to support the fragments by means of two compresses, stretched along the lateral borders of the bone, and confined by adhesive strips and a roller. When the fissure is very oblique, the displacement may be such as to demand a course of treatment similar to that which is necessary in a transverse fracture.

When the patella has once been broken transversely, it is exceedingly liable to a recurrence of the same accident from comparatively slight muscular contraction. The judicious practitioner should, therefore, always put the patient upon his guard in this respect. The fracture may occur at the same point, but generally it takes place a little higher up. Finally, when one patella has been broken, the other is apt to suffer in the same manner, owing to the imperfect use of the affected limb, and the consequent liability of the patient to fall.



## FRACTURES OF THE FEMUR.

## 1. FRACTURES OF THE SHAFT.

The shaft of the femur may be broken in any portion of its extent, but there are three points which are particularly obnoxious to fracture. These points are the upper fourth of the bone, the middle, and the inferior fourth, the relative frequency of the accident being in the order here stated, although it is generally asserted that the bone yields more frequently at or near its middle than anywhere else. This idea, however, accords neither with the results of my observations upon the living subject, nor with my examinations of specimens of fractured bones in different collections. The relative difference, however, is, no doubt, very slight. A brief account of the lesion, as it occurs at these several points, will suffice to place the subject in a proper practical light, and serve to prevent those sad mistakes, often so disastrous both to the patient and the attendant.

*Fractures of the Upper Fourth of the Shaft.*—The most common site of fracture of this portion of the bone is from two and a half to three inches and a half below the small trochanter; the line of fracture is almost always oblique, extending from behind forwards, and from above downwards, being frequently from an inch and a half to two inches in length. A transverse fracture here is an exceedingly rare occurrence. It is also very uncommon to see the bone give way just below the small trochanter, and it is worthy of note that, when it does break at this point, it is generally complicated in its character, or associated with extra-capsular fracture, properly so termed.

The *symptoms* of fracture seated in this portion of the femur are generally so obvious as to indicate at once the nature of the injury, the characteristic signs consisting of great shortening and angular deformity. The shortening varies from two to four inches, and usually exists in full force immediately after the receipt of the injury. The superior portion of the limb is remarkably distorted, being convex on its external surface, with a corresponding concavity internally, occasioned by the overlapping of the ends of the broken bone, the upper nearly always lying in front of the lower, and both being usually directed somewhat outwards. In ten specimens of fracture of the upper fourth of the shaft of the femur, now before me, I find that in all, except one, the upper fragment is in front of the lower, the reverse being the case in the other. In these ten specimens the superior piece is drawn forwards and outwards in six; in two it is tilted upwards and inwards; and in two it is raised up and in a straight line with the lower, or without any lateral deviation whatever. The distance of the fracture from the small trochanter ranges from two inches and two-thirds to three inches and a quarter.

In the six specimens in which the superior fragment is directed forwards and outwards, the lower fragment is also inclined outwards in four, the junction between them being such as to give the bone more or less of an arched appearance, the convexity being external

and the concavity internal. In the two specimens in which the upper end is directed forwards and inwards, the lower end, in one, is inclined inwards also, and in the other it is straight, or in a line with the superior fragment. In seven of the eight specimens in which the displacement is lateral, the inferior fragment is more or less strongly everted, and, consequently, the knee and foot, during life, must have been in the same position.

The fractures, so far as can be determined, were all oblique, the line of disjunction, in nine, extending from behind forwards, and from above downwards, one only being in the opposite direction, and in this the lower fragment lies in front of the upper, overlapping it four inches. The distance at which the ends of the bone are separated anteriorly, varies from half an inch to an inch and three-quarters. The angle which the superior fragment forms with the inferior, does not, in any of the ten specimens exceed  $45^{\circ}$ , while in most it falls considerably short of this.

I have been thus particular in giving the results of these examinations, on account of their practical bearing upon fractures of the superior extremity of the shaft of this bone. Sir Astley Cooper, and those who have adopted his views, have evidently formed very erroneous ideas, not only as regards the extent and direction of the displacement of the upper fragment, but also of its causes. Thus it has been asserted that the upper end often overlaps the other almost at a right angle, which is not the case in any of the specimens that I have examined; on the other hand, it has been alleged that the two pieces are usually inclined outwards, which the specimens alluded to also disprove, there being no lateral deviation whatever in two, while in two others the projection was inward, leaving thus only six cases of outward displacement. The displacement forwards of the upper end is due to the joint action of the psoas and iliac muscles, assisted perhaps by the pectineal and the short head of the adductor, while it is dragged outwards by the agency mainly of the external rotators. The lower fragment, on the contrary, is drawn up by the action of the flexor muscles of the thigh, and outwards by the tensor, vastus, and gluteal muscles. That the direction of the fracture materially influences the direction of the displacement is shown by the fact that in the only specimen out of the ten examined by me in which the line of fracture extended from before backwards, and from below upwards, the lower fragment overlapped the upper, and that to a great extent.

Although the specimens here described are, I conceive, of great pathological and practical value, yet it must not be forgotten that any inferences deducible from their examination are impaired, in some degree, by the fact that the displacement which characterizes them may have been influenced more or less by the nature of the treatment. Thus, in consequence of the use of splints, the ends of the fragments, originally inclined inwards or outwards, may have been pushed and held in the opposite direction, thus completely reversing the primitive order of the deformity, as caused by the direction of the fracture, the weight of the limb, and the action of the muscles.

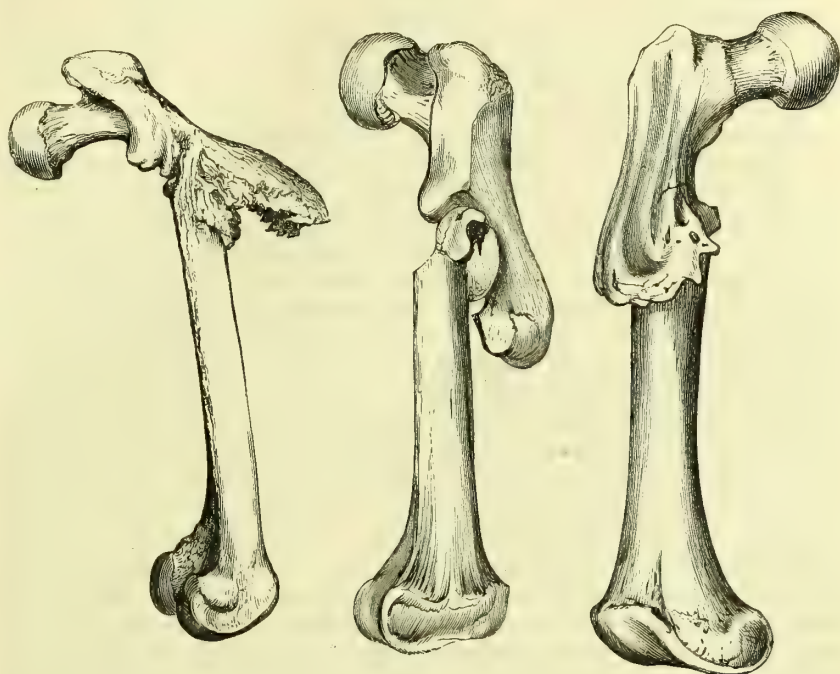
The annexed drawings, two of which are from my own preparations,

will serve to illustrate the nature of the displacement so often met with in fractures of the superior portion of the shaft of the femur.

Fig. 121.

Fig. 122.

Fig. 123.



*Fractures at the Middle of the Shaft.*—A fracture at the centre of the shaft of the femur is, according to my observation, an uncommon occurrence; most generally the bone gives way some distance above or below this point. The line of fracture is, for the most part, very oblique, extending from behind forwards and from above downwards, and the consequence is that the superior fragment nearly always overlaps the inferior, the lower extremity of which is drawn backwards and usually, also, somewhat outwards, by the action of the flexor muscles, causing thus an amount of shortening of from two and a half to three and even four inches, with more or less angularity at the site of injury, and marked eversion of the limb. The lower end of the superior fragment, on the contrary, forms a prominent projection on the fore part of the thigh, easily perceived by sight and touch. The symptoms are of course characteristic.

A perfectly horizontal fracture of the shaft of the femur is an extremely uncommon occurrence; so much so that, although the phenomena might be such as to lead to the suspicion of its existence, the idea that it really is an injury of that kind should not be carried out in practice, lest, the requisite extension and counter-extension being omitted, permanent shortening should follow. When there is no marked tendency to displacement, it will generally be found that the fracture, instead of being transverse, is slightly impacted, or that its



extremities, being denticulated, are interlocked with each other, and thus held in place. Comminuted fracture of this portion of the shaft is not uncommon, especially in old subjects, laboring under fragility of the osseous tissue.

The accident may be the result of direct violence, as a kick, or the passage of the wheel of a carriage, in which case it is often of a compound or complicated character; or it may be occasioned indirectly by a fall upon the foot or knee.

*Fractures of the Inferior Fourth of the Shaft.*—Fracture of the inferior portion of the shaft of this bone derives a special interest from the fact that, when occurring very low down, the inferior end of the upper fragment may, especially if it be very long and sharp, penetrate the joint, and thus seriously complicate a case otherwise easy of management. The fracture, moreover, is liable to be compound, the upper piece piercing the muscles and integuments just above the knee. As in fracture of the other divisions of the shaft, already described, so in this the line of the solution of continuity generally ranges from behind forwards and from above downwards, a transverse fracture, properly so termed, being extremely uncommon. The degree of obliquity is variable; but generally it is so considerable as to cause great shortening of the limb and angularity of the part; which, together with the everted state of the knee and foot, are characteristic signs of the accident. The inferior fragment is always drawn backwards and upwards, its superior extremity forming a distinct prominence in the popliteal region, which can easily be effaced by restoring the pieces to their natural position. When the fracture occupies the lower extremity of the shaft, nearly on a level with the joint, the upper fragment may descend so far down as to push the patella away from the trochlea of the femur, over upon the tibia, so as to create an appearance simulative of partial luxation of this little bone. If several hours have elapsed since the receipt of the injury, the diagnosis is sometimes obscured by the tumefaction of the joint; but, in general, whatever may be the condition of the parts, any existing doubt may be cleared up by a thorough examination of the limb.

The relative position of the fragments in this fracture are well depicted in the accompanying cut (fig. 124), from a specimen in my cabinet.

Fig. 124.



The causes of fracture in this situation are commonly of a direct nature, a greater amount of force seeming to be necessary to produce it than when it is situated higher up. It may, however, be induced in an indirect manner, as when a person, falling from a considerable height, alights upon his foot or knee, the violence of the shock being concentrated upon the inferior portion of the femur.

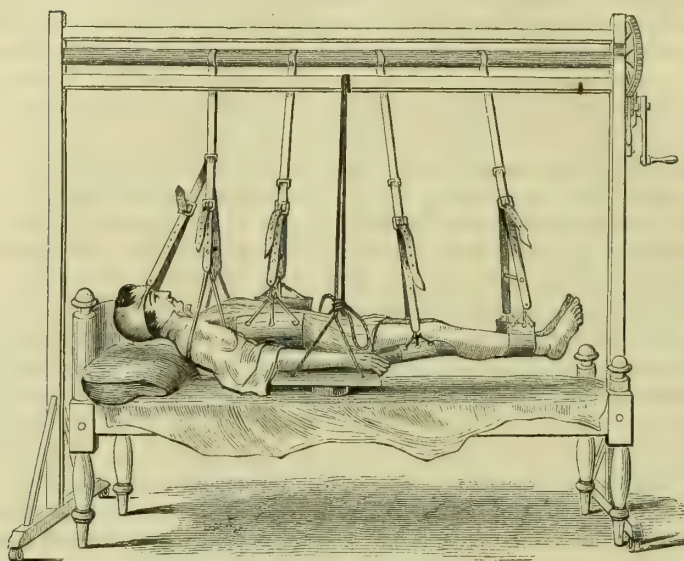
*Treatment.*—The treatment of fractures of the shaft of the thigh-bone may be conducted according to several plans, of which that by extension and counter-extension, the limb being in the straight position, is, as a general rule, the most eligible, fulfilling, as it does, more effectually than any other, the different indications presented by this class of injuries. Before any steps, however, are taken to adjust the broken pieces, it is the duty of the attendant to see that a suitable bed is procured for the comfortable accommodation of his patient, as well as for the secure management of the case. This subject having already been discussed in a previous part of the work, it will, therefore, be sufficient for my present purpose, if I merely allude to it here, with the hope of enforcing its importance upon the mind of the reader. I am so thoroughly convinced of the utter impossibility of treating fractures of the femur successfully without a good bed, that I should consider any surgeon justifiable in declining to undertake the management of any case unless his efforts were properly seconded in this respect. There must be no compromise upon the subject; for, if the cure turn out badly, no allowance will be made by the patient and his friends for any deficiencies, short-coming, or want of co-operation on their part. The whole blame falls upon the professional attendant, it being very properly assumed that he ought to know better than any one else what the emergency demands, and that he should, therefore, spare no pains to meet it. A fracture-bed must have three qualities; it must have slats, a good, firm, but elastic mattress, and arrangements for the evacuation of the bowels, so that the patient may not be compelled to rise when he wishes to relieve himself. These qualities are all admirably combined in the ingenious contrivances of Dr. B. H. Coates, Dr. Addinell Hewson, and others, which my limits, however, will not permit me to describe.

When both thighs are broken, or even when only one is affected, Jenks' fracture-bed, represented by the accompanying cut (fig. 125), will be found extremely convenient, both for evacuating the bowels and for making up the bed. It is thus described by Dr. Gibson:—

"It is composed of two upright posts about six feet high, supported each by a pedestal; of two horizontal bars, at the top, somewhat longer than a common bedstead; of a windlass of the same length placed six inches below the upper bar; of a cog-wheel and handle; of linen belts, from six to twelve inches wide; of straps secured at one end of the windlass, and at the other having hooks attached to corresponding eyes in the linen belts; of a head-piece made of netting; of a piece of sheet-iron twelve inches long, and hollowed out to fit and surround the thigh; of a bed-pan, box, and cushion to support it, and of some other minor parts."

For the purpose of securing quietude of the limb, and accuracy

Fig. 125.



Jenks' fracture-bed.

of apposition of the ends of the fragments, numerous contrivances have been devised, all possessing, apparently, more or less merit, and yet not one of them so perfect as to be wholly unexceptionable. A bare description and delineation of all the fracture apparatus now before the profession would form a stately volume. The surgical cabinets of some of our medical schools contain cart-loads of such material, most of it as effete as the contents of a curiosity-shop. Much of this apparatus has been patented, and extensively distributed by the inventors. The character of most of it is familiar to me, and I do not hesitate to declare that a large proportion of it is most villanous. The great and fundamental principles which every contrivance of the kind must necessarily possess is enjoyed by all, though in different degrees of perfection, and it cannot be doubted that the constant multiplication of such machinery, and the implicit confidence reposed in it by the younger members of the profession, have been a prolific source of the many disastrous results that have so frequently, especially of late years, attended the treatment of fractures of the thigh. I have long been satisfied that the more simple the apparatus is, the more easily is it managed, and the more likely to prove efficient. With a proper knowledge of what is needed, and a little ingenuity on the part of the surgeon, the requisite means for the successful management of almost any case of fracture of the femur, however bad, may generally be provided upon the spur of the occasion, or, at all events, within a reasonable time after the occurrence of the injury.

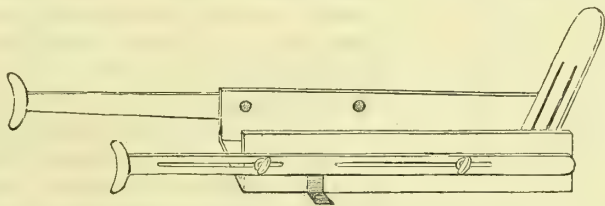
In children, I have usually found the most convenient and suitable apparatus to be a case made of stout, unoled sole-leather, long enough to extend from the groin to an inch and a half below the heel, and sufficiently wide to come well round the limb, especially the thigh. It



is supplied with a foot-piece of the same material, and is well padded at its upper extremity, to prevent undue pressure upon the perineum. The outside portion of the trough is continued for some distance over the hip, to which it is secured by a spica, or common roller, carried round the thighs and pelvis. A splint, also of leather, or of binder's board, gutta-percha, or thin wood is stretched along the forepart of the limb from the groin to the patella, wadding being suitably interposed to ward off pressure; the apparatus is held in place by means of an ordinary bandage, adhesive strips having been previously secured to the leg and attached to the foot-piece. The dressing is completed by placing the limb, with its apparatus, in an easy position upon a hair or cotton bolster, gradually tapering upwards, its thickness below not exceeding four inches. By this simple contrivance I have always found it easy to obtain the requisite extension and counter-extension, the perineum affording a *point d'appui* which effectually prevents the ascent of the apparatus, while the foot-piece serves to keep the foot in place, at the same time that it receives the extending bands.

In fractures of the thigh-bone in adults, a more substantial apparatus is usually necessary, as there is generally a greater tendency to muscular contraction and displacement of the fragments. The apparatus which is usually employed in this country is that of Desault, as modified and improved by Physick. It is, however, an awkward contrivance, constantly subject to derangement, and the results obtained by its aid are by no means so gratifying as they should be. It has always been found extremely unsatisfactory in my practice, and hence I have for many years never employed it in a single case, having given the preference to the fracture-box, represented in the annexed sketch (fig. 126). This box, which I used, for the first time, upwards of

Fig. 126.

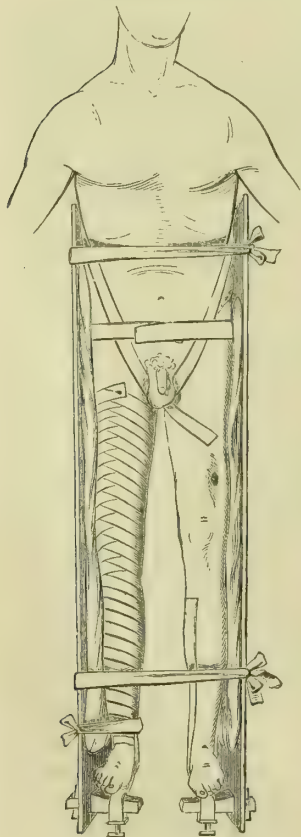


twenty years ago, extends from the tuberosity of the ischium to a level with the sole of the foot, which rests against the vertical piece, provided with two slit-like holes for the passage of the extending bands. The posterior surface of the box is hollowed out for the more easy accommodation of the thigh and leg, while the side-pieces, fastened by hinges to the horizontal one, project so as to come to a level with the surface of the limb in front. To the outside of the box is secured a movable splint, about two inches in width, crutch-shaped and well padded above, and long enough to reach into the axilla, while another, similarly arranged and constructed, is attached to the inside, being intended to press against the perineum. The whole apparatus is made as light as possible, and any intervals that may exist between

it and the limb, after it has been properly adjusted, may be filled with cotton, tow, or, what is preferable, especially in compound fractures, with wheat bran, the latter answering an admirable purpose, under such circumstances, not only affording an agreeable protection to the broken bone, but absorbing the discharges and preventing the development of maggots, which are so liable to form in such cases in hot weather. In changing the dressings, all that is necessary is to let down the sides of the box, the extension being kept up, if necessary, in the meantime, by an assistant having hold of the foot. A broad leather splint, or one of binder's board, extending from the groin to the knee, should cover the thigh in front; it should be accurately moulded to the parts, and be firmly secured in its place by means of pieces of tape encircling the box.

Instead of the fracture-box now described, use may be made of two splints, one of binder's board and the other of wood, the former, which is intended for the inside of the thigh, reaching from the groin to the knee, while the other, placed along the outside of the limb, extends as high up, on the one hand, as the crest of the ilium, and, on the other, as low down as four inches below the level of the sole of the foot.

Fig. 127.



These splints being well padded, are secured with an ordinary roller, the adhesive strips being attached to the inferior extremity of the long one, in order to keep up the requisite degree of extension.

Within the last few years adhesive plaster has been much employed in this city, both for maintaining extension and counter-extension in fractures of the thigh, chiefly through the influence and writings of Dr. Gilbert and Dr. Neill. The practice, which is rapidly coming into general vogue, is unquestionably, as stated elsewhere, a great improvement upon the ordinary means heretofore in use, as it not only tends to preserve better and closer union of the ends of the fragments, but, what is a matter of great moment to the patient, prevents the pain, chafing, and ulceration, which so frequently attend the old methods. The treatment is equally serviceable in simple and compound oblique fractures of the lower extremity.

In a remarkable case of compound fracture of both thigh-bones, in a boy eleven years of age, recently under the care of Dr. Gilbert, a most excellent cure was effected by means of adhesive plaster, aided by the apparatus, represented in the accompanying cut (fig. 127); the dressings being removed on the forty-fifth day. A long splint, it will

be perceived, was stretched along the outside of each limb, from a few inches below the sole of the foot to within a short distance of the axilla; the extending strips, tied under the sole of the foot, and secured to a horizontal block, were controlled by a tourniquet; while the counter-extending strips were carried along the pelvis, both in front and behind, and firmly fastened by transverse bands passed round the hip-bones, the back, and abdomen.

Whatever apparatus be employed, whether those now described, or others of a similar character, there are several circumstances which should claim the special attention of the practitioner in the treatment of fractures of the shaft of the femur, and which may be stated in the form of aphorisms.

1st. Care must be taken that the ends of the broken bone are steadily maintained on a line with each other; any tendency to angularity, lateral distortion, or tilting up of the fragments must be promptly counteracted by pressure opposite the point of projection. This disposition manifests itself, more or less, in nearly all fractures of the femur, and should never for a moment be lost sight of, lest it be not discovered until it is too late to remedy it. It is particularly strong when the fracture is seated from two and a half to three inches below the small trochanter, in consequence of the action, on the one hand, of the iliac and psoas muscles, and the external rotators, on the other, the former, as before stated, tilting the lower end of the superior fragment forwards, and the latter outwards. For want of attention to this circumstance, wretched deformity of the limb is a frequent consequence of this lesion.

2d. Proper care must be taken that no *shortening* occurs. To prevent this, constant vigilance must be exercised in regard to the tightening of the extending and counter-extending bands. If any doubt exist, a comparative estimate must be made from time to time of the length of the two limbs, by stretching a piece of tape from the centre of the umbilicus to the inferior and inner border of each patella, the body and limbs lying perfectly plumb.

3d. A slightly *everted* condition of the limb being that which is most natural when the body is dorsally recumbent, the surgeon should aim to maintain it in that position during the period necessary to obtain reunion of the ends of the broken bone.

4th. The *heel* must be seen to; for if it be neglected it will be sure to inflame and ulcerate, if not slough. Too much care, therefore, can not be taken to ward off pressure by filling up the hollow on each side of the tendo-Achillis with cotton, or employing, if necessary, a small air-bag, or a bladder partially filled with water.

5th. *Extension* must be maintained with two broad strips of adhesive plaster, stretched along the sides of the leg nearly as high as the knee, secured by cross-pieces, and fastened to the foot-board of the splints or fracture-box; the surface being carefully shaved prior to their application. Or, instead of this, two long and broad strips of linen or muslin are secured to the limb by means of a roller, the upper extremity of each being turned loop-like down upon itself, over the bandage, and fastened by carrying the roller downwards. The gaiter



and handkerchief should not be used in any case, for reasons previously mentioned.

The *perineal band* must also receive due attention, otherwise it will be sure to gall and fret the parts, and thus greatly distress the patient. Besides, if not properly managed, it will be extremely apt to displace the upper fragment, by pushing it outwards, away from the inferior.

6th. In *compound fractures*, one of the splints may be bracketed, as originally recommended by Dr. Hayes, of Indiana, the method having been adopted by him during our war with England, in 1813 and 1814. The opening which is thus left affords ready access to the wound, and, consequently, great convenience for the application of the necessary dressing.

7th. Much objection has been urged by certain writers against the *bandage* in the treatment of fractures of the thigh, on the ground not only that it is inconvenient, but absolutely useless. My experience does not corroborate this statement. On the contrary, I have always derived the most marked benefit from it, and would not, therefore, on any account, omit it. While I should hardly know how to control muscular spasm without it, it is one of the most powerful means we can employ to counteract the tendency to shortening, so common in nearly all fractures of the thigh. To answer the purpose, however, it must be applied with great care; otherwise harm, not benefit, will result.

In simple fractures of the thigh, the ordinary roller is sufficient, but in compound fractures preference is given to the bandage of Scultetus, inasmuch as, being composed of separate strips, it admits of more easy removal and reapplication.

The *starch bandage* may often be employed with great advantage, giving adequate support to the broken limb, and enabling the patient to take exercise in the open air, or about the house, upon crutches, a matter frequently of great importance. My experience, however, is averse to its use in the early stage of the treatment; applied too soon after the accident, before there is pretty complete subsidence of inflammation and swelling, it may do incalculable harm, not only greatly aggravating the local trouble, but endangering the safety of the limb by the induction of gangrene. For these reasons, therefore, I seldom resort to it before the end of a fortnight or the beginning of the third week.

8th. Care must be taken to keep off the bedclothes from the fractured limb, as their weight would not only be oppressive, but tend to derange the ends of the fragments. The best way of accomplishing this is to cut a stout barrel hoop through at the middle, and to place the two halves, tied firmly together crosswise, over the injured extremity. Or, instead of this apparatus, the surgeon may use the frame depicted at page 120.

Mr. Pott, of England, conceived the idea that the best mode of treating fractures of the femur was to place the affected limb upon its outside, the body inclining in the same direction, and the knee being in a semi-flexed state. The leg and foot, supported upon smooth pillows, were elevated somewhat above the level of the thigh, which was enveloped by a many-tailed bandage, and covered in by two broad,

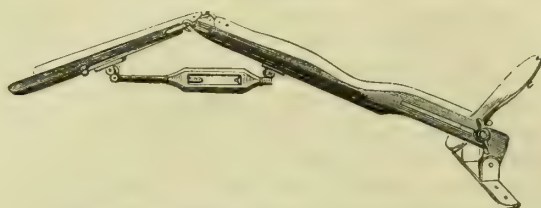
carved wooden splints. This plan, which Mr. Pott recommended with all the enthusiasm of a man of genius, was founded upon the erroneous notion that it would completely relax the different sets of muscles connected with the broken bone, thus preventing them from acting injuriously upon its fragments; forgetting that, in proportion as he took off the tension from one class, he necessarily increased that of another. It has been found altogether impossible to carry out this plan successfully in practice, experience having shown that the patient is utterly unable to remain so long in one position without suffering greatly from bed-sores, and that the apparatus, with all the care that can be taken to keep it in place, is wholly inadequate to answer the purpose of an accurate adjuster.

Another mode of treating fractures of the body of the femur, quite different from any hitherto described, was much in vogue at one time, both in England and in this country, chiefly in consequence of the influence of the late Sir Charles Bell, by whom, if it was not originated by him, it was extensively employed for a long time at the Middlesex Hospital, London. It consists in placing the limb upon two grooved cushions, resting upon two pieces of board, united by hinges in the form of a double inclined plane, and long enough to extend from the tuberosity of the ischium to the back part of the heel. A roller having been previously applied from the toes to the groin, two light, but firm binder's board splints, carefully softened in hot water, are secured to the outer and inner parts of the thigh, meeting nearly in front, and reaching from the groin to the knee. The extremity is now laid over the inclined plane, in an easy, comfortable position, the angle of flexion having special reference to this point; the foot is attached to the foot-board, and the limb and plane being tied firmly together by tapes, or, what is better, a bandage, the dressing is completed.

The method of treatment by the double inclined plane ought not to be too lightly condemned, for it cannot be denied that very excellent cures are occasionally effected with it. Much less frequently employed now than formerly, it is more particularly applicable to the treatment of fractures of the condyles of the femur and of the upper extremity of this bone, attended with a constant disposition to displacement of the lower extremity of the superior fragment. It may also be advantageously employed in compound fractures, attended with severe contusion and laceration of the integuments, where confinement in the extended position would be productive of violent pain and extreme discomfort. The extension is made mainly by the weight of the leg and foot, while the counter-extension is made by the pressure of the apparatus against the tuberosity of the ischium. The annexed drawing (fig. 128), represents M'Intyre's splint, or double inclined plane, modified by Liston. Fig. 129 exhibits it as it is applied to the limb.

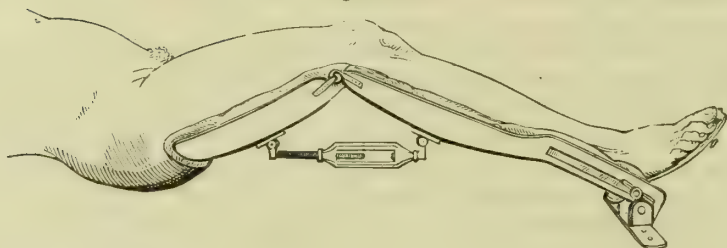
Finally, when *both thighs* are broken the case may be treated with a double inclined plane, or a fracture-bed, the hinges being arranged in such a manner as to permit the trunk to be raised or lowered at pleasure, without causing any motion of the hips. The limbs should be well protected with side and front splints, and be immovably tied together.

Fig. 128.



McIntyre's splint, simplified and improved by Liston.

Fig. 129.



The period required for the consolidation of fractures of the shaft of the femur must necessarily be greatly influenced by circumstances, as the age and health of the patient, and the care with which the ends of the fragments have been kept together. In children of from five to fifteen years, complete union may usually be looked for in from twenty-four to twenty-eight days. In eighteen cases, analyzed by Dr. A. L. Peirson, of Massachusetts, the cure in persons of thirty years of age and under, occupied 35.88 days; while in seventeen, where the age was upwards of thirty, the average period was 36.64 days; thus showing only a very trifling difference in the two series.

It has been asserted by many highly respectable practitioners that it is always extremely difficult, if not impossible, to effect a cure in fractures of the shaft of the thigh-bone without some degree of shortening, and my opinion is that this conclusion is only too well founded. There can be no question at all that in many cases a certain degree of shortening is absolutely and positively unavoidable, not on account of any defect in the treatment, but from the very nature of the fracture itself. How is it possible it should be otherwise, when the ends of the fragments are driven the one into the other? The best skill and the most devoted attention would utterly fail, under such circumstances, to make a good limb. So, also, when the fracture is compound or comminuted, more or less deformity and shortening will almost be inevitable. In the New York Hospital, where fractures of the shaft of the thigh-bone are very common, and where this accident is probably treated with as much adroitness and care as anywhere in the world, from a third to half an inch of shortening is generally looked for, as a natural consequence, by the surgeons of the Institution, and it is questionable whether the statistics of other similar establishments, if they could be ascertained, would exhibit a more favorable result.



## 2. FRACTURES OF THE INFERIOR EXTREMITY.

Fracture of the condyles of the femur is, in comparison with that of the humerus, an extremely infrequent occurrence. Indeed, it is very uncommon anyhow, not only relatively, but absolutely speaking. Sir Astley Cooper mentions only two instances of the kind in his work on Dislocations and Fractures; the Dupuytren Museum at Paris, so rich in osteological preparations, contains but five specimens of the lesion; and in the admirable collection of Dr. Mütter, not a single bone, illustrative of the occurrences, is met with. The cabinet of Professor Gibson, the elder, now at Richmond, has, however, several beautiful specimens of fracture of the condyles; and among my own preparations is a very rare one, in which these eminences are broken off vertically, leaving the trochlea attached to the lower end of the shaft, which exhibits a remarkably comminuted appearance, consisting of not less than five distinct fragments.

The fracture may be limited to one of the condyles, which, however, is extremely rare, or it may implicate both, the fissure in the latter case extending between the two prominences, and terminating above in an oblique fracture of the shaft, so as to give rise to three distinct fragments. From the amount of force required to produce this fracture, it is generally attended with a great deal of injury to the soft parts, and for the same reason, it is not unfrequently of a compound and comminuted character, the ends of the fragments protruding either externally or projecting into the cavity of the knee-joint. A partial fracture of one of the condyles occasionally occurs. In rare cases, the fracture presents the character of impaction, the lower end of the shaft being forcibly impelled into the cancellous structure of the condyles, which are completely severed in their entire length.

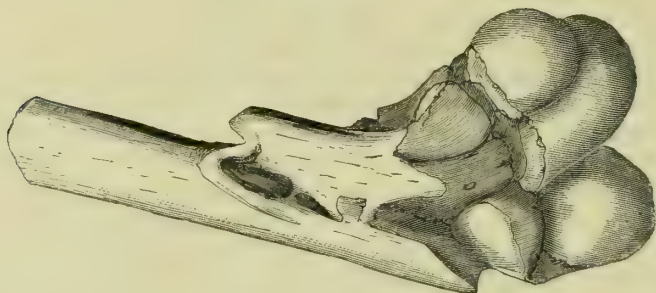
Whatever form the fracture may assume, it is nearly always the result of direct violence; generally of a fall upon the knee, the passage of the wheel of a carriage, or the kick of a horse. In one of the three cases that have fallen under my observation, it was occasioned by a fall from a high scaffolding, the individual, a man upwards of fifty years of age, alighting upon his feet, but striking, before he could recover himself, his knee against a large stone. The subjects of these fractures are usually old persons, in whom the condyles of the femur have become atrophied and brittle from the effects of interstitial absorption and fatty degeneration.

The *symptoms* of fracture of the condyles are not always well characterized, owing to the fact that the fragments are generally held in place by the ligaments of the knee, thus preventing marked deformity, and rendering the production of crepitus difficult. The joint appears to be wider and flatter in front than usual, and if the patella be pressed backwards, the condyles may be considerably separated, so as to increase the transverse diameter of the limb. The joint is much swollen and bruised, the member is completely powerless, and, when the fracture affects both prominences, there is nearly always marked shortening, often amounting to from one to two inches, the lower frag-

ment being drawn up behind the superior by the action of the hamstring muscles. When only one condyle is broken, the deformity, other things being equal, will be less than when both suffer, and there will also, of course, be less shortening.

In the specimen of vertical fracture of the condyles in my cabinet, previously alluded to, the short fragment is drawn upwards against the posterior surface of the shaft of the femur, to the distance of at least two inches, its upper surface looking towards the trochlea, with which it forms an obtuse angle, thus greatly increasing the antero-posterior diameter of the joint. The various appearances of this rare specimen are well represented by the adjoining sketch (fig. 130).

Fig. 130.



Fracture of both condyles occasionally simulates a partial luxation of the head of the tibia backwards. In a case reported by Professor Neill, the symptoms resembled much more those of an accident of this kind than those of a fracture of the condyles. The leg being thrown backwards, rendered the patella remarkably prominent in front, but there was no increased breadth of the knee, no crepitus, and no contortion of the foot, at the same time that there was no difficulty in making passive flexion and extension of the joint. The best diagnostic consists in taking hold of the condyles, and attempting to press them in opposite directions, which cannot, of course, be done, if there be no fracture. The same procedure can hardly fail to elicit crepitation, although this may be rather slight, especially if the fragments are held pretty firmly together by the ligaments.

The *prognosis* of this fracture is especially grave, on account both of the injury done to the soft parts, and of its connection with the joint, which may be involved in an alarming degree. The fracture may, as already stated, be compound or comminuted, and when this is the case the danger will, of course, be greatly increased, perhaps to such an extent as to require amputation, or, when this is not deemed advisable, in such a manner as to jeopard life by mortification, pyemia, erysipelas, or congestive pneumonia.

The *treatment* will usually require, in the first instance, to be strictly antiphlogistic, leeches and evaporating lotions being necessary, on account of the injury done to the soft parts. The limb, enveloped in a bandage, is laid in an easy position, and free use is made of anodynes in order to prevent spasm so common and annoying after these acci-

dents. As soon as the inflammation has been sufficiently subdued, the fragments are restored to their proper position, and maintained by appropriate apparatus, the limb being extended, if the fracture be transverse, or nearly so, or placed over a double inclined plane, if it be very oblique, with a strong tendency to displacement of the broken ends. Passive motion is instituted at the expiration of a month, but, despite the attention of the surgeon, a good and unexceptionable cure will be extremely difficult, if not impossible, especially when both condyles are implicated.

*Complicated fractures* of the condyles are occasionally met with, principally as the result of direct violence, such as the passage of the wheel of a carriage, or of gunshot injury, and are among the most dangerous of accidents, bringing life in jeopardy by tetanus, erysipelas, pyemia, and profuse suppuration and hectic irritation. The danger is proportionably increased when the lesion is attended with extensive wound of the knee-joint, or a comminuted condition of the bone. An attempt may be made to preserve the limb when the patient is young and in good health at the time of the fracture, when the weather is not too hot and exhausting, and when the injury in the soft parts is comparatively slight; under opposite circumstances, on the contrary, the best plan will be to amputate on the spot, immediately after the occurrence of reaction. To hesitate, in such a case, would only be to trifle with the patient's life, which could hardly fail to be the forfeit of the surgeon's timidity.

### 3. FRACTURES OF THE SUPERIOR EXTREMITY OF THE FEMUR.

The superior extremity of the femur comprises the head and neck of that bone, together with the two trochanters, so that in an individual of ordinary stature it is from three inches and a quarter to three inches and a half in length, there being, however, no distinct boundary line between it and the shaft. The head composes nearly two-thirds of a sphere, and rests upon the neck, which is inclined obliquely upwards and inwards, so as to form an obtuse angle with it; they are surrounded by the capsular ligament, the strongest membrane of the kind in the body, and consist of a large amount of spongy tissue, inclosed by a thin lamella of compact substance. Both these structures undergo important changes in consequence of advancing age, the former becoming greatly rarefied, light, and porous, while the latter is so attenuated as to be, in some places, hardly as thick as common letter paper. These changes, the necessary effect of which is to render the bony texture frail and brittle, are particularly conspicuous after the fiftieth year, and are a principal cause of the frequency of fracture of the neck of the femur at and after this period of life. There is another circumstance, also, which powerfully contributes to this occurrence, and that is the alteration which the position of the neck of the femur undergoes, causing it, in many cases, to stand off almost at a right angle with the shaft of the bone, or even to sink below this level. This change in the obliquity of this portion of the bone is, as a general rule, more common, as well as more marked,

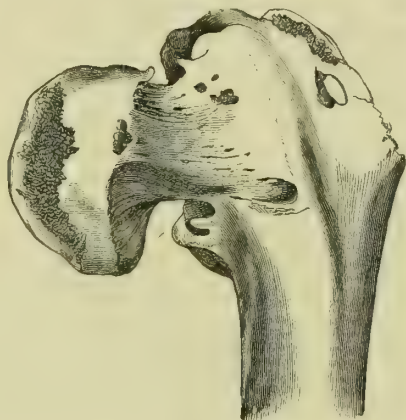


in women than in men, and hence it is that the former are always more liable to fracture of the neck of the femur than the latter. These various appearances are well illustrated in the adjoining sketches. Fig. 131 represents the ordinary normal shape of the head and neck, together with its spongy and compact structures. Fig. 132, from a

Fig. 131.



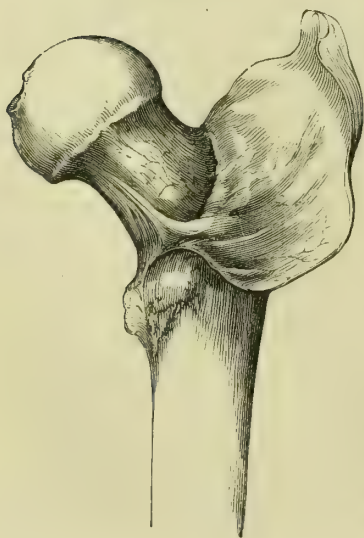
Fig. 132.



preparation in my collection, affords a good idea of the changes which these parts experience in consequence of the effects of age.

A thorough knowledge of the disposition and strength of the two ligaments of the hip-joint is of great consequence in the study of fractures of the superior extremity of the femur, both as it respects their symptoms and mode of reparation. The capsular ligament (fig. 133) represents a kind of shut sac, which is attached, on the one

Fig. 133.



hand, to the periphery of the cotyloid cavity, and, on the other, to the prominent lines which extend, in front and behind, from one trochanter to the other, thus including both the head and neck of the bone. It descends further down on the anterior than on the posterior surface of the neck, and is thicker and stronger above and behind than in any other portion of its extent. Anteriorly, it is strengthened by the psoas, iliac, and crural muscles, together with a band of ligamentous fibres; posteriorly, by the

geminal, pyriform, and inner obturator muscles; internally, by the pectineal and outer obturator muscles; and superiorly, by the small gluteal.

The inter-articular ligament—the round ligament of anatomists—is a dense, triangular bundle of fibres, which arises from the depression upon the head of the femur, not far from its centre, and is inserted into the lower margin of the cotyloid ligament, where the latter is stretched across the notch in the acetabulum, the depth of which it thus serves to increase.

These two ligaments, maintaining the head and neck of the femur in their proper position, generally sustain serious injury in fracture of the superior extremity of the bone. When the lesion is intra-capsular, the capsular ligament is usually completely torn across so as frequently to admit of the escape of the upper extremity of the inferior fragment through the rent, either on the spot, or soon afterwards, thus accounting, in some degree, for the shortening experienced by the limb. The upper fragment, on the contrary, hangs on, as it were, to the round ligament, which thus supports and nourishes it, its vascular and nervous supplies being cut off in every other direction.

There is another point of great practical interest in the anatomy of the neck of the femur, which, from the influence it exercises over the repair of fractures, deserves brief mention here. I allude to the fact that this portion of the bone is nearly destitute of periosteum, thereby disqualifying it, in great degree, for the formation of callus, an occurrence which is still further opposed by the circumstance that this part is invested by a synovial membrane; which, in case of accident, always pours out a large quantity of fluid, the interposition of which between the ends of the fragments becomes thus a powerful obstacle to their reunion. Occasion will be afforded of speaking again of these various points as we proceed with the discussion of the nature and treatment of fractures of the neck of the femur.

Fractures of the neck of the femur are divisible into two classes, those, namely, which occur within the capsular ligament, and those which take place exterior to it; the former being now usually termed intra-capsular, and the latter extra-capsular. The distinction, as will be seen by and by, is one of great pathological as well as practical importance, and is, therefore, worthy of profound consideration.

#### INTRA-CAPSULAR FRACTURES.

Fracture of the neck of the femur within the capsular ligament, may occur at any portion of this part of the bone, as exhibited in the accompanying figures, 134, 135, and 136; but, in general, it is met with at a short distance below the head, or between the head and centre of the neck, where the compact structure appears to be unusually weak, and where, consequently, the slightest force frequently produces the accident. Sometimes the line of fracture is on a level with the globular head, which, therefore, alone constitutes the upper fragment; and, on the other hand, cases are observed where the bone yields just above the attachment of the capsular ligament. Finally, the fracture is

Fig. 134.



Fig. 135.



sometimes partly within and partly without the ligament forming an interesting variety, especially in reference to the question of the process of consolidation. The direction of the fracture is usually oblique; but it may be perfectly perpendicular, especially when the neck, in consequence of age or disease, forms a right angle with the shaft of the bone.

Fig. 136.



Fig. 137.



An incomplete variety of intra-capsular fracture has been from time to time recognized by surgical observers, but much doubt has always been entertained by many in relation to the possibility of such an occurrence. I have myself never met with an example in the numerous dried specimens that I have examined in different collections, and I, therefore, assume that the accident must be extremely uncommon. A well-marked instance of the kind occurred in 1856 to Dr. J. B. S. Jackson, of Boston, in a man, aged forty-two years, in consequence of a fall through two stories of a building upon a hard floor, breaking his spine and the femur at several points. The fracture of the neck,



commencing at its junction with the head, reached, as is seen in the accompanying diagram (fig. 137), in a nearly perpendicular direction, to within about a quarter of an inch of the inferior and internal wall of the bone, the fissure being so extensive as that, if the man had been able to walk, the unbroken part would probably not have been able to support the weight of his body.

The *cause* of intra-capsular fractures is generally some trivial accident; most commonly a fall upon the great trochanter, or a blow upon the hip when the thigh is fixed and separated from its fellow, thus increasing the strain upon the upper portion of the bone. I have known the injury to be produced by the great toe catching in a fold of the carpet, while the person, an old lady of seventy-six, was walking across the floor. In London, according to Sir Astley Cooper, it most frequently occurs from the foot suddenly slipping off the edge of the side-walk over the curb-stone, upon the carriage pavement, the weight of the body being thus thrown forcibly upon the neck of the bone in a perpendicular direction, when it is unprepared for such an event. Cases are recorded of the fracture having happened in consequence of the individual having turned awkwardly in bed, or of having stepped carelessly out of the bed upon the floor, in either case powerfully twisting the thigh-bone. The fact that so serious a lesion may occur from so trivial a cause, while it is of great value in a diagnostic point of view, affords the clearest possible proof that a bone, liable to be so affected, cannot be very sound, but, on the contrary, that its structure must have undergone serious changes to render it capable of an accident, which, in other pieces of the skeleton, requires an extraordinary degree of force. That this is the case, as a general principle, has already been shown, the immediate cause being the atrophied and rarefied condition of the compact and spongy tissues of the neck of the bone, the animal matter being absorbed, and the earthy alone left, the result of the whole being a weakened condition of the affected parts, and, consequently, a predisposition to fracture. Although the lesion is usually occasioned by slight accidents, yet instances are observed where the reverse is the case, but then it is worthy of remark that it is ordinarily of a complicated character.

The *age* at which this variety of fracture occurs is, diagnostically considered, a matter of great importance. A fracture in other bones, or parts of a bone, may take place at any period of life, even in infancy and early childhood. Thus, I have seen the shaft of the femur itself broken in an infant of four weeks. But it is very different with the neck of this bone within the capsular ligament, experience having shown that it is subject to fracture only, as a general rule, after the age of fifty, when, as already stated, its spongy and compact tissues suffer from atrophy and fatty degeneration, thus rendering it more or less brittle, and incapable of withstanding injury. The youngest subject in whom this fracture has been observed, was a lady of eighteen, whose case has been reported by Mr. Stanley, of London. Sir Astley Cooper saw an instance at thirty-eight. Doubtless other examples have occurred, but they do not disprove the rule that this variety of fracture is an occurrence of advanced life.

*Sex* also exerts a considerable influence upon the production of intra-capsular fracture. Of its precise relative frequency in males and females, no reliable statistics, at least none upon a large scale, have been placed before the profession; but a sufficient amount of information has been obtained to justify the assertion that it is much more common in the latter than in the former. In the tables of Mr. R. W. Smith, of Dublin, in his Treatise on Fractures, the sex is given in twenty-eight cases, of which nineteen were women and eleven were men. The cause of this difference appears to be twofold, the more horizontal position of the neck of the thigh-bone and the greater amount of atrophy and fatty degeneration of this portion of bone in old females than in old males.

The intra-capsular fracture may be *complicated* with fracture of the neck on the outside of the capsular ligament, the lines of disjunction running into each other. Such an occurrence, indeed, is not infrequent. Again, an intra-capsular fracture may be associated with a fracture of the great trochanter; but this is extremely rare. In twenty-three specimens of this lesion in the Dupuytren Museum at Paris, there is not a solitary example of such a union.

The *symptoms* of intra-capsular fracture are deserving of particular attention. They are: 1. Shortening of the thigh. 2. Eversion of the foot. 3. Preternatural mobility. 4. Crepitation. 5. Change of position in the great trochanter. 6. Pain at the site of injury. 7. Peculiarity of the patient's body in the erect position. Each of these symptoms, except, perhaps, the last, possesses a positive value, and must, therefore, be considered somewhat at length.

The *shortening* of the thigh, or of the limb through the thigh, is one of the most striking phenomena of this variety of fracture, and is the more valuable because of its almost universal occurrence. It is usually the first circumstance that attracts the attention of the surgeon, whether the patient be lying on his back, or standing up. As might be expected, it varies in different cases and in different conditions of the same patient, its extent being greatly influenced by the state of the capsular ligament, being generally less in proportion to the integrity of this membrane, and conversely. It is always less immediately after the occurrence of the injury than it is after the lapse of several days, and also in impacted fracture than in the ordinary form of the accident. The amount of immediate shortening ranges from half an inch to an inch; but it may be considerably less than this, not, perhaps, exceeding three lines; and, on the other hand, it may reach an inch and a quarter, and even an inch and a half, especially if there be extensive laceration of the capsular ligament. During the progress of the case, the shortening will not unfrequently amount to upwards of two inches, while in rare cases it has been known to exceed three.

The diminution in the length of the limb, although generally immediate, is not always so, depending, perhaps, not so much, as has usually been supposed, upon the integrity of the capsular ligament, as upon the want of separation of the ends of the fragments, in consequence of the peculiar arrangement of their surfaces favoring their temporary contact. It is hardly reasonable to imagine that, if the integrity of the

capsular ligament were the only cause of it, this ligament would become so stretched or torn within so short a time after the accident as to admit of the amount of shortening above mentioned. We must, therefore, seek for some other cause, and I know of none that is so plausible as the one here suggested. Under such circumstances, the shortening generally takes place suddenly; perhaps after the patient has made considerable exertion with his limb, several days, it may be, after the accident, in consequence of the instantaneous unlocking, as it were, of the ends of the fragments. When the fracture is impacted, the shortening will, of course, be immediate, and will also be likely to be permanent, unless the broken pieces are pulled forcibly asunder by the surgeon in the examination of the limb, or by the patient in his efforts at walking or turning about in bed.

*Eversion* of the foot, or, rather, of the whole limb, is another striking and constant symptom, being seldom absent in any case. When the patient stands up, it is such as to cause the heel of the affected side to point towards the hollow between the ankle and tendo-Achillis of the sound limb; while, when he is recumbent, the foot inclines outwards almost horizontally, dropping involuntarily upon its outer surface, nearly, or quite, in contact with the floor. The eversion, although generally an immediate effect of the accident, does not always reach its maximum until some time after, depending upon the manner in which the ends of the fragments are held together. When the fracture is impacted, it may be entirely absent, or the foot and knee, instead of being everted, may be more or less turned in the opposite direction.

The cause of the eversion of the limb, in this accident, has been differently explained. Most writers ascribe it to the action of the external rotator muscles, which being connected with the superior extremity of the bone, thus readily roll the thigh outwards when it has lost its support above, the irritation consequent upon the fracture being an additional incentive to contraction. Others, on the contrary, and I include myself among the number, attribute it altogether to the weight of the limb, which has a natural tendency to eversion whenever the internal rotators are thrown off their guard, as is observed during sleep, when, the extremity being perfectly passive, the foot invariably inclines outwards.

*Preternatural mobility*, common to all fractures, is particularly observable in the intra-capsular variety, and therefore serves as an important diagnostic sign of the accident. There are cases, however, in which it is absent; in some entirely, as in the impacted fracture, and in others only in the early stage of the injury, as when the ends of the bone are held partially together by the interlocking of their fibres, by the incompleteness of the solution of continuity, or by some other cause. Its existence, as well as its degree, is always readily ascertained by taking hold of the limb and rotating it upon its axis, or flexing it upon the pelvis, extending it behind the line of the sound limb, or carrying it inwards or outwards; movements which cannot be executed when there is a dislocation of the head of the femur. Extension and counter-extension will have the effect of restoring the



limb promptly to its proper length, but as soon as the forces are discontinued the original shortening is reproduced.

*Crepitation*, the most valuable sign of all in fractures generally, is rarely wanting in this. Indeed, it can only be absent in the impacted form of the lesion, or in those cases where the ends of the fragments remain still partially in apposition with one another. In general, it is discoverable immediately after the accident, and may, of course, be produced as long as the fracture continues ununited. In order to determine its existence, it is necessary to bring the ends of the broken bone fully in contact by extension and counter-extension, when, upon rotating the limb, it will at once declare itself.

Change of position in the *great trochanter* is always a symptom of importance in intra-capsular fracture. This bony prominence is not only drawn upwards towards the ilium, in this accident, but it is brought in close contact with the border of the acetabulum, and is, therefore, much less easily felt and seen than in the normal state, in which it is always so conspicuous. Moreover, when the thigh is rotated upon its axis by taking hold of the foot, the great trochanter will be found to turn, as it were, upon a pivot, or to move in a segment of a lesser circle than natural. From the circumstance of the limb being generally strongly everted, the portion of the broken neck attached to the trochanter is directed inwards and upwards, being thus placed in closer proximity with the anterior superior spinous process of the ilium than the trochanter itself.

*Pain* at the site of injury being common to all fractures, is of special value only in connection with the other symptoms already described. It derives its chief importance from the fact that it is located at the upper and inner part of the thigh, in the direction of the small trochanter, and that it is always greatly increased whenever an attempt is made to rotate the limb, to bend it upon the pelvis, or to carry it inwards over the sound one. When the patient is perfectly quiet, the limb being placed in a relaxed position, the suffering is usually very trivial, except in cases where the bone has received, along with the fracture, a severe degree of concussion, when the pain will frequently be excessive. It is generally worse, too, at night than in the day, and in dry weather than in wet.

There is a peculiarity in the *patient's attitude* as he stands up, which cannot fail to strike the most careless observer. The body, in this position, is inclined forwards in such a manner as to throw its weight upon the sound limb, which is firmly planted upon the floor, while the other hangs off in a constrained, unseemly, and awkward manner; the foot and knee are strongly everted; the leg is supported upon the ball of the toes, while the heel, resting in the interval between the ankle and tendo-Achillis, is elevated from two to three inches from the surface; the natural prominence of the hip is destroyed; and the least attempt to walk or raise the limb, not only proves abortive, but is productive of exquisite pain.

Finally, there is seldom much *swelling* in this variety of fracture; it is only when the hip has been struck a severe blow that the superficial parts are likely to be the seat of any considerable effusion,

ecchymosis, discoloration, or contusion, and even then the symptoms are usually very evanescent.

The *pathological* appearances in intra-capsular fracture vary very much, according to the period of the examination, as well as the character of the original injury. In recent cases there is usually some sanguineous effusion, although the quantity of blood is generally very small, unless, as occasionally happens, there is a rupture of the capsular ligament, when it may be considerable. Most commonly the ligament preserves its integrity, but if the accident has been unusually severe it may be torn at one or more points, so as to admit of the partial escape of the inferior fragment, the soft covering of which is often partially detached, hanging off in loose, irregular shreds. If several days have elapsed since the receipt of the injury, the changes will be such as are evincive of inflammation. The synovial membrane will be observed to be unnaturally vascular, and to be slightly coated with plastic matter, a small quantity of which is also sometimes found upon the ends of the fragments. There is likewise, at this stage, a marked increase of synovial fluid, and the structures around the joint frequently exhibit a contused appearance with more or less infiltration of blood and serum.

If the dissection be made after the lapse of some months, the capsular ligament will be found to be much thickened by interstitial deposits, as well as by the addition of plastic matter to its synovial lining; the head and neck of the bone are also incrustated with lymph; and the ends of the fragments are softened, unnaturally vascular, and rounded off, or partially connected by fibro-ligamentous bands. The inter-articular ligament retains its normal structure, except in rare cases, in which it is inflamed and changed into fibrous tissue.

In old cases, or such as have been on hand for some years, there are not only great thickening and induration of the capsular ligament, but extraordinary alterations in the broken bone, the neck of which is often completely annihilated, the shaft terminating abruptly on a line with the two trochanters. At other times the neck is converted into a short, conical knob, partially incrustated with cartilage, or scooped out, as it were, into a sort of cup-like depression. The trochanters themselves are occasionally a good deal changed in their appearance, especially the great, which is liable to be diminished in size and altered in configuration. The head of the bone generally retains its position in the acetabulum, but that portion of the neck which remained attached to it at the time of the accident is usually totally absorbed; and cases occur, though they are rare, where the entire fragment is destroyed, or where it is represented by the merest possible remnant held in place by the round ligament. When the head is left, its lower surface is occasionally hollowed out into a kind of socket for the reception of the rounded conical end of the lower fragment; or the reverse obtains, the head being rounded off, and the lower fragment scooped out. In either event, the two extremities, continually moving upon each other, in time acquire a smooth, polished, eburnized character, the better qualifying them for the performance of their various functions.

The mode of *repair* of intra-capsular fractures is peculiar, and,

therefore, deserving of special attention. Injuries of this description generally unite by osseous matter, which passes through the same phases as the primitive osseous tissue, a considerable period always elapsing before the final completion of the process; but in this variety of fracture the connecting medium is always of a fibro-ligamentous nature, similar to that which is observed in fracture of the olecranon process, the patella, and skull. But it is not always that the surgeon is to look even for such a union, imperfect as it is; in many cases the ends of the broken bone refuse altogether to unite, being gradually rounded off, and, perhaps, slightly incrustated with cartilage, or, as not unfrequently happens, especially in very aged and decrepit subjects, becoming, in time, completely absorbed, the lower fragment disappearing as far down as the two trochanters, and the upper as high up as the brim of the acetabulum. In rare cases, indeed,

Fig. 138.



we see even the entire head removed, together with the greater portion both of the round and capsular ligaments.

A very excellent idea of the fibro-ligamentous union of this variety of fracture is afforded by the annexed sketch (fig. 138), copied from the work of Sir Astley Cooper. It was taken nine months after the accident, the patient being between thirty and forty years of age.

The causes of this want of union are of easy recognition. In the first place, the parts have to encounter the prejudicial influence which results from the difficulty of maintaining accurate apposition of the broken ends of the bone; a circumstance which is so essential to

the successful reparation of fractures in other pieces of the skeleton, but which it is almost impossible to effect here, in consequence of the want of proper leverage in the upper fragment. All the apparatus that has yet been devised for the purpose has utterly failed to accomplish the object; whatever may be done, more or less motion is inevitable. Secondly, the accident is always followed by a considerable degree of synovitis, and, as a necessary consequence, by an increased quantity of synovial fluid, which, bathing the ends of the bone, may be supposed to act inimically to the consolidating process. Thirdly, the greatest reason, however, of all, why the intra-capsular fracture does not unite by osseous matter, is because the extremities of the fragments have not a sufficient amount of strength to furnish the requisite plastic and organizable deposit, their vessels and nerves being torn and destroyed at the time of the accident. The superior and smaller fragment, represented by the globular head of the bone, or the head and a little remnant of the neck, is dependent solely for its vascular and nervous supplies upon the round ligament, and every one who knows how small this ligament is, and how insignifi-



cant its vessels are in the natural state, must be aware how utterly inadequate it must be for the nourishment of the bone to which it is attached. It need not then be wondered at that there is never any show of new osseous matter on the part of this fragment. Nor does the inferior fragment fare much, if any better, in this respect. Destitute, in great measure, of fibrous covering or periosteum, with many of its vessels in a hopelessly lacerated condition, its powers are too feeble to afford any substantial aid in the process of osseous union. Hence the result must necessarily always be as above stated; that is, there will either be no reparation at all, or if an attempt be made at establishing a connection between the two fragments, that attempt will go no farther than the formation of a fibro-ligamentous substance.

When no effort whatever at repair occurs, it is highly probable that the ends of the fragments speedily undergo the fatty degeneration, and that then they become an easy prey to the action of the absorbent vessels, eventuating in their final annihilation.

It would, perhaps, be going too far to deny altogether the possibility of bony union in intra-capsular fracture of the thigh-bone, and yet I have no hesitation in asserting that I have never seen what I could regard as an unequivocal example of the kind. I have examined most of the specimens in this country, purporting to be cases of osseous consolidation, and in no instance have the appearances been such as, in my opinion, to justify such a conclusion. In general, the history of these cases has either been so exceedingly defective, or the necroscopic characters have so closely resembled those witnessed in the changes which the head and neck of the femur undergo in consequence of old-age or disease, as to destroy all confidence in their authenticity as genuine cases of intra-capsular fracture. I need not insist here upon the great difficulty which the practitioner frequently encounters in establishing a correct diagnosis in injuries about the hip; what skill and care it generally requires to discriminate accurately between a mere sprain and a fracture, or a fracture and a dislocation; or how frequently even slight lesions of the ileo-femoral articulation, and of the head and neck of the femur, are followed by changes in the structure and conformation of these portions of bone which might so closely simulate those produced by fracture as to deceive the most enlightened and cautious observer.

The question, then, in regard to the repair of intra-capsular fracture, resolves itself into four groups of facts, which may thus be stated: 1. Under favorable circumstances, both as it respects the patient and the treatment, there may be fibro-ligamentous union, answering the purpose of a sufficiently strong bond to admit of tolerable progression after recovery from the more immediate effects of the accident. 2. Under adverse circumstances, that is, when the patient is old, decrepit, or worn out by disease, and cannot, in consequence, submit to the proper treatment, or when, although the system is sufficiently vigorous, the case has been injudiciously managed, no consolidation whatever will take place, and not only so, but the neck of the bone, or both neck and head, will be absorbed, the limb remaining, of course, permanently shortened and deformed. 3. Osseous union, although, per-

haps, not wholly impossible, is yet so exceedingly infrequent as that it cannot reasonably be looked for in any case, however propitious the circumstances attending it, both as it respects the patient and the skill and attention of his attendant. The event, other things being equal, will be most-likely to happen in the impacted form of the injury, and in the ordinary fracture in comparatively young and robust persons than in the very old and decrepit. 4. When the fracture is of a mixed character, that is, partly within and partly without the capsular ligament, the mode of repair will be similar to that of ordinary fracture, although the process will require more time and care for its successful completion.

The *prognosis* in this variety of fracture is embraced in the above discussion respecting its repair, and need not, therefore, engage further attention here. In regard to life, the danger is generally inconsiderable, as the lesion is usually the result of very trivial accidents, involving no serious injury to the soft parts, or any comminution of the bone. In respect, however, to the limb, as the consolidation of the fracture is always more or less imperfect, its usefulness will necessarily be impaired in a degree proportionate to the defective character of the connecting medium. For a long time, the patient is obliged to employ a crutch, but eventually he is able to walk with the aid of a stick and a high-heeled shoe, the parts strengthening by exercise, notwithstanding there is a strong tendency to atrophy of the muscles.

*Treatment.*—Fractures of the neck of the femur within the capsular ligament are not, I think, generally as well managed as they should be, owing chiefly, if not wholly, to the influence of the writings of Sir Astley Cooper, who taught that, inasmuch as there never is any osseous union in this variety of injury, it was not, therefore, proper to torture the patient with a protracted confinement in the recumbent posture, and the application of the extending apparatus. He considered such a proceeding the more necessary because a great majority of the subjects of this fracture are old and decrepit persons, many of whom bear confinement very badly, soon becoming affected with foul bed-sores, and eventually perishing from hectic irritation or congestive pneumonia. In accordance with this view, he was in the habit of placing the limb upon a long pillow, in an easy position, and of maintaining it in this situation for a fortnight or so, until the pain and inflammation, consequent upon the accident, had in great measure subsided. The patient was then allowed to leave his bed, and sit in a high chair, or walk about on crutches, care being taken to bear, at first, very gently upon the foot for fear of disturbing and fretting the ends of the fragments. Subsequently, as the limb improved in strength, a high-heeled shoe was worn, and a stick was substituted for the crutches.

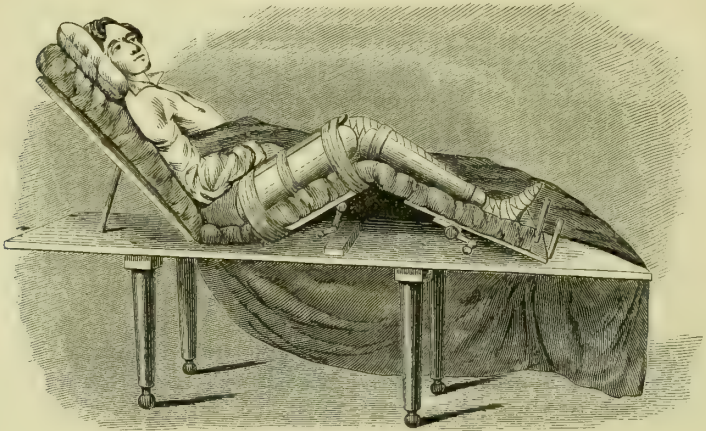
If this treatment were the exception, and not the rule, every practitioner of sense and experience would concur in its propriety; but the English surgeon, in his desire to generalize it, has carried it much farther than the interests of our patients justify. It is unquestionably true that many of the subjects of intra-capsular fracture do not bear confinement well; they suffer from the slightest restraint, and soon become bedridden. Such cases are extremely difficult to manage,

and are not likely to be benefited by the use of splints, or any other mechanical contrivances calculated to compress the limb and hold it in an uneasy and constrained position. To this class, the treatment of Sir Astley Cooper is peculiarly applicable; indeed, no other can be employed. All that can be done is to make the patient comfortable, and let the limb get on as best it may. But there is another class of subjects, who, though perhaps a good deal advanced in years, are, nevertheless, quite stout and robust, enjoying excellent health at the time of the accident, whose constitution has never been impaired by intemperance or excess of any kind, and who can bear the long confinement incident to such an accident with the most perfect impunity. The persons composing this class are, for the most part, residents of the country, and not the poor, broken-down inhabitants of crowded cities, without any bodily vigor, and, therefore, without any recuperative power. Hence, an exclusive plan of treatment should not be adopted; on the contrary, it should be varied according to the exigencies of each particular case. Such a course is the more necessary because it is utterly impossible always to determine positively, by the most careful examination, whether the case is one purely of intra-capsular or extra-capsular fracture, or whether it partakes, as it not unfrequently does, of the character of both, the two being conjoined.

Acting upon the above principles, I have, for many years, treated most of the cases of intra-capsular fracture that have come under my notice as any other fracture of the femur, by permanent extension and counter-extension, not with the hope, as already stated, of obtaining bony consolidation, but with the view simply of keeping the ends of the fragments more accurately in contact, and thus affording them an opportunity of becoming united by fibro-ligamentous tissue. It is obvious that such a result can only reasonably be anticipated when this condition is fully complied with. When the broken pieces are permitted to overlap each other constantly, hardly any union will be possible, certainly none of a useful kind; and there is, moreover, under such circumstances, always great risk that at least the neck, if not also the greater portion of the head of the bone, will be absorbed, and the patient, in consequence, never regain the functions of his limb. Should the treatment fail, the surgeon has the consolation to know that he has discharged his duty, by having kept the parts in the only position in which it is ever possible for them to become united in any way. The limb may be maintained in the extended position, and the apparatus which best fulfils this indication is that depicted at page 221; or, instead of this, the limb may be placed in an easy position over a double inclined plane; or, what is better, when it can be procured, the patient may be put upon a Daniel's fracture-bed, represented in the adjoining cut (fig. 139). The latter contrivance, which, unfortunately, however, is too expensive for general private use, is particularly adapted to cases of old persons likely to require protracted confinement. The bed is so arranged that, while the patient can sit up, or vary his position, efficient extension and counter-extension may be maintained with adhesive strips. An elaborate description of the apparatus will be found



Fig. 139.



Daniel's fracture-bed.

in the tenth volume of the Transactions of the American Medical Association.

Whatever plan of treatment be adopted, its effects should be most carefully watched, so that it may not prove irksome, much less injurious. The length of time during which the patient should be confined must vary, on an average, from ten weeks to three months and a half. During all this trying period he should be on a full allowance of meat and porter; at all events, upon a generous diet, in order to sustain the system and promote reparation. Purgative medicines and all other depressing means should be used as sparingly as possible. Anodynes must be freely given in the evening to allay pain and procure sleep.

#### EXTRA-CAPSULAR FRACTURES.

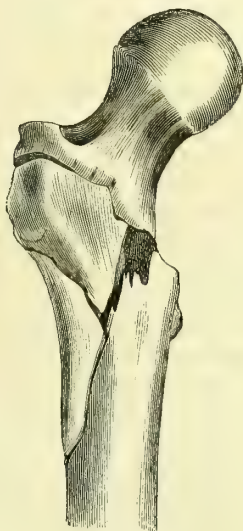
The extra-capsular fracture is situated at the base of the neck of the femur, extending from above downwards and from behind forwards in the direction of the intertrochanteric line. It is not always, however, as the name declares, strictly exterior to the capsular ligament; on the contrary, it not unfrequently passes above the attachment of the ligament, so as to partake of the character both of an inner and an outer fracture of the neck. Moreover, the injury is always associated with fracture of the trochanters, sometimes with one, at other times with both, thus leaving in the former case three fragments, and four in the latter. Again, the fracture is often comminuted, independently of its connection with the trochanters; and in the great majority of instances it is attended with more or less penetration of the superior piece into the inferior. My own observation, however, induces me to believe that, generally speaking, the penetration is very trivial, hardly ever exceeding three lines, and often not reaching even so high as that. The two accompanying cuts (figs. 140 and 141) afford a good idea of the situation and direction of the extra-capsular fracture.

The extra-capsular fracture is not as common as the intra-capsular;

Fig. 140.



Fig. 141.



the difference, however, is trivial. Men are somewhat more subject to it than women, and, while it may take place at any period of life, experience teaches that it is met with almost exclusively after the age of fifty, by far the greater number of cases occurring after the sixtieth year. It is generally supposed, and, no doubt, correctly, that a much greater amount of violence is required to produce this fracture than the intra-capsular, but the rule admits of many exceptions. The most common exciting cause is a fall or blow upon the hip; it may also follow a fall upon the foot or knee and the passage of the wheel of a carriage across the pelvis or upper part of the limb. Finally, cases occur where it happens from the body being crushed by a heavy load descending upon the back, the lower extremities being in a fixed state at the moment of the accident. In not a few instances, however, the fracture is occasioned by very slight causes, while in most there is reason to believe that the bone where the lesion occurs is in a remarkably brittle condition, predisposing it to the disruption of its fibres. In some of the preparations that I have examined in different osteological collections the compact structure, although not very seriously diminished in thickness, was almost of a vitreous consistence, while the spongy was extremely rarefied and expanded, thus occasioning great weakness of the part. The inter-cervical portion of the bone frequently retains, under such circumstances, a remarkably healthy appearance. When the osseous tissue is so very fragile at this point it is not improbable that it may occasionally give way under mere muscular contraction, as has happened in at least one well authenticated case, the patient, a woman, aged eighty-three, having met with the accident in an effort to preserve her equilibrium when in the act of falling.

The *symptoms* of this variety of fracture bear a strong resemblance to those of the intra-capsular, some existing in a less and others in

a greater degree, but none of them, considered separately, possessing any diagnostic value. In describing these symptoms it will be most satisfactory if they be presented in the same order as in the preceding case.

The *shortening*, which is a constant occurrence, varies from half an inch to an inch, as its minimum, to an inch and a half, as its maximum. In exceptional cases it may, however, amount to two inches and upwards. It is usually greatest when there is a badly comminuted state of the parts, or when the great trochanter, forming a part of the upper fragment, is drawn uncommonly far outwards, so as to permit the lower fragment to ride considerably over the upper. Moreover, it possesses this peculiarity that it is generally as great immediately after the fracture as at any period afterwards.

The knee and foot are generally *everted*, the limb lying as if it were perfectly powerless, the muscles having apparently lost all influence over it. This symptom is even more striking than in the intra-capsular fracture. Eversion, however, is not so constant an occurrence as in the latter accident; in a considerable number of cases the limb is strongly rotated inwards, and in both varieties, but especially in the former, the displacement is occasionally so obstinate as to require an unusual degree of force to rectify it, depending, doubtless, upon the interlocking of the fragments.

The extra-capsular fracture is characterized by complete *mobility* of its fragments, except when they are impacted, an occurrence which, as already stated, is more common here than in fracture within the capsule. The loss of function is also complete, the patient being unable to lift the limb by the effort of his muscles, or to execute any of its natural functions.

The *crepitation* is generally very distinct, being often loud and crackling, and is readily perceived by the hand and ear, applied to the hip when the limb is rotated upon its axis. It is usually more marked than in intra-capsular fracture, and does not, as in the latter, require extension and counter-extension for its production. When the fracture is badly comminuted, the fragments may often be readily detected with the fingers, and be made to move upon each other so as to emit a grating sound not unlike that caused by rubbing together several pieces of broken china.

The position of the great *trochanter* may be the same as in the intra-capsular fracture, obeying the movements of the limb, and turning as it were upon a pivot, instead of describing the segment of a lesser circle, as it does in the natural state. In many cases, however, it is completely detached, and then, of course, it either remains stationary on rotating the foot, or it follows the inferior fragment as a separate body. In general, it will be found to be somewhat further off from the spine of the ilium than in the intra-capsular fracture, depending upon the smaller amount of retraction of the limb.

The *pain* is always unusually severe, and is greatly increased by every attempt at motion and manipulation; it is more superficial than in intra-capsular fracture, and is concentrated, as it were, upon the two trochanters.



The *swelling* is also uncommonly extensive, and there is nearly always considerable discoloration of the surface, owing to the contused and ecchymosed condition of the skin and subcutaneous cellular tissue, the latter of which is often extensively infiltrated with blood.

The *attitude* of the patient has nothing in it that is peculiar; it partakes of the same general character as that which is met with in intra-capsular fracture, and, in fact, so closely simulates it as to be distinguished from it with difficulty.

Finally, along with the symptoms now described there is generally, in extra-capsular fracture, evidence of severe shock immediately after the occurrence of the accident, and the resulting reaction is not unfrequently followed by high fever, lasting often for a number of days, and requiring great attention on the part of the professional attendant. In intra-capsular fracture the patient may feel very faint, but he soon recovers, and seldom has much constitutional disturbance afterwards.

The *reparation* of the extra-capsular fracture is effected in the same manner precisely as fracture of any other piece of the skeleton provided with periosteum. It differs, therefore, wholly, in this respect, from that of the intra-capsular form of the lesion. Here osseous union is the rule, the want of it the exception, the reverse being the case in intra-capsular fracture. The period at which the consolidation will be completed will, of course, depend, as a general rule, upon the age and health of the patient, the presence or absence of complications, and, above all, upon the care which is observed in keeping the ends of the fragments in accurate apposition.

Although the extra-capsular fracture invariably unites by osseous matter, yet the *prognosis* is very far from being always favorable either as it respects the possibility of avoiding deformity and lameness, or the possibility of saving the patient. When the fracture is comminuted, or the bone is broken into a number of pieces, including the two trochanters, a good result is hardly to be anticipated under the most judicious management that the case can receive. Under such circumstances the neck of the bone, having lost its support, is pushed downwards and inwards below its natural level, and the consequence is that a certain degree of shortening with deformity of the upper part of the thigh will be inevitable. The same result will, of course, follow when the fracture is impacted. These facts should be well studied and appreciated, and should always be promptly communicated to the patient, lest, when the cure is completed, he might blame his attendant for making him a bad limb when it was impossible to make a good one.

From the great violence that is so frequently inflicted upon the parts, both soft and hard, the extra-capsular fracture often proves hazardous both to limb and life. Occasionally, though rarely, the patient dies from shock; in some instances he suffers greatly from the effects of excessive reaction. Most generally, however, when there is danger, life is put in jeopardy by the supervention of erysipelas, or pyemia, the former commonly setting in within the first forty-eight hours from the occurrence of the fracture, and the latter towards the end of the first week or the beginning of the second. Some idea of the danger of extra-capsular fracture may be formed when it is stated that of eighteen

cases, treated in the Richmond Hospital at Dublin, nine proved fatal, the period of death ranging from the fifth to the fifteenth day. In some cases the patient sinks from the exhaustion consequent upon extensive suppuration or the formation of large sloughs over the sacrum and buttocks from protracted confinement in one position.

The *treatment* of extra-capsular fracture differs in no wise from that which is necessary in fracture of the shaft of the bone. The limb, being placed in the straight position, is kept perfectly at rest by means of splints, stretched along its outer and inner surfaces, and connected below in such a manner as to admit of the requisite extension and counter-extension until a cure is effected. The foot should incline *slightly* outwards to favor relaxation of the external rotator muscles, and special care should be taken to prevent overlapping of the fragments, or angular deformity, by the use of a gutta percha splint, accurately moulded to the outer and anterior part of the thigh, and well secured by the bandage. The dressing should be continued for at least five weeks.

#### IMPACTED FRACTURES OF THE NECK OF THE FEMUR.

Fracture of the neck of the femur occasionally presents itself as an impacted lesion, the lower extremity of the upper fragment being forcibly impelled into the cancellated structure of the upper end of the lower fragment, the great trochanter being usually carried along with

Fig. 142.



Impacted fracture of the neck of the femur.

the descending portion. The accident, which is sufficiently rare, and of which the accompanying cut (fig. 142), from a specimen in the Mütter collection, affords a beautiful illustration, is nearly always associated with extra-capsular fracture, and occurs under two varieties of form, the complete and incomplete, of which the latter is by far the more frequent. Old persons only are subject to it, and it is most common in those in whom the neck of the femur is of inordinate volume in consequence of the expansion of its spongy structure. The line of fracture is generally at the base of the neck, or at the junction of the neck with the shaft, the penetration occurring in the direction of the anterior surface of the bone, with which the neck is more immediately continuous, being separated from it behind by a well-marked depression, and by the large ridge connecting the two trochanters. The fracture usually hap-

pens from the body being crushed by the falling of a heavy substance upon the trunk, while the chest is inclined forwards, and the knee

rests upon a solid surface, the hip at the same time receiving a severe blow, as when a person is buried by the caving in of a coal bank; or, it may be produced by a fall from a height upon the knee, in which the weight of the body is violently impelled in the opposite direction, the two forces continuing to act after the bony tissues have given way. The direction of the fracture is generally oblique, extending from above downwards, from the great to the small trochanter, both of which are not unfrequently included in the injury, as seen in the annexed cut (fig. 143).

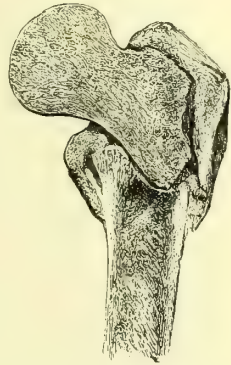
The distance at which the upper fragment is buried in the lower varies from a few lines to half an inch, three-quarters of an inch, or even an inch, depending upon the degree of the impelling force and the amount of expansion of the cancellated structure at the base of the cervix. The compact substance of both fragments is often extensively comminuted, and the fragments, themselves, are usually interlocked in such a manner as to give the thigh-bone the appearance of being twisted upon its axis, the limb after the accident being generally everted, as in fracture without impaction, though less marked.

There is a variety of impacted fracture of the neck of the femur in which the lower fragment is impelled into the reticulated structure of the upper. The occurrence is very rare, and the amount of shortening a good deal less than in the more common form of the injury.

The *symptoms* of impacted fracture of the neck of the femur are in general quite characteristic, though a good deal of care is necessary, in every case, in order to make a correct diagnosis. The most valuable and reliable phenomena are the shortening of the thigh, eversion of the foot, the ability of the patient to walk, or to bear the weight of the body upon the thigh, after the accident, and the resistance which the fragments offer to extension and counter-extension when an attempt is made to restore the limb to its natural position. The pain is usually very intense, generally much more so than in ordinary cervical fracture, and there is not unfrequently extensive ecchymosis over the great trochanter, causing unwonted swelling and discoloration.

The degree of shortening varies, as already stated, from a few lines to an inch or more, the average ranging from a quarter of an inch to half an inch, which it rarely exceeds. The eversion of the foot, although well marked, generally exists in a slighter degree than in fracture of the neck of the bone without penetration, whether the injury be seated on the outside or within the capsular ligament. The occurrence is the more valuable as a diagnostic from the fact that it is rarely, if ever, entirely absent. Owing to the fact that the continuity of the femur is preserved, the patient is generally able to walk after the accident, although not without much suffering, or, at all events, to bear the weight of his body upon the affected member. For the same reason,

Fig. 143.



Impacted fracture, through the trochanters. The upper fragment is wedged into the lower.



the limb is easily rotated upon its axis, bent upon the pelvis, extended, abducted, or adducted; and when an attempt is made to restore it to its normal length, the effort, unless very powerful, ordinarily fails, the ends of the fragments retaining their interlocked position, despite the extension and counter-extension. Finally, there is generally, in addition to the symptoms now described, more or less deformity, although this cannot always be easily detected on account of the excessive swelling, and, when present, is not, of course, characteristic.

What, then, are the most important phenomena in a diagnostic point of view? Beyond all doubt the shortening of the thigh, the immobility of the limb, the existence of deformity at the hip, in the situation of the great trochanter, and the absence of crepitation. When these signs are present, it may be assumed that there is no dislocation of the ileo-femoral joint, nor any ordinary fracture of the neck of the femur, but fracture of this portion of the bone with impaction of the upper fragment.

The *prognosis* of this variety of fracture is much more favorable than that of ordinary fracture of the cervix; for inasmuch as the fragments are firmly wedged together, it usually requires but little callus to effect their consolidation. Besides, very little retentive apparatus is usually necessary, the two fragments serving as their own splints. On the other hand, however, there must always remain a certain degree of deformity, consisting of slight shortening of the limb, and of an incurvated state of the thigh just below the hip. Some permanent lameness may, therefore, reasonably be looked for after the accident, even under the most favorable circumstances. I have seen several specimens of impacted fracture of the neck of the femur where great and irremediable ankylosis was produced by osseous matter being extended, in the form of bridges, from the seat of the injury to the innominate bone, immediately around the acetabulum, connecting the two together in a solid mass.

These protective means are displayed in a remarkable manner in a specimen, above depicted, of impacted fracture of the neck of the left femur in Dr. Mütter's collection. The head and neck of the bone, being two inches and nearly three-quarters in length, occupy a horizontal position in regard to the shaft, the neck being driven into the cancellated structure of the latter some distance below the trochanters. The superior third, or more, of the shaft is bent strongly forwards and outwards, and is surrounded by a casing of new osseous matter, more than half an inch in thickness at the concavity of the curve, or weakest portion of the femur, and at a point, consequently, where, after such an accident, the greatest amount of support is required. A large ledge of bone, two inches long, and very broad, thick, and firm, projects from the anterior and inner aspect of the superior extremity over towards the hip-joint, being connected by a strong, round ligament, upwards of two inches in length, with the anterior inferior spinous process of the ilium, which juts out as a remarkably long, slender prominence, more than twice the normal size. An idea of the amount of shortening of the femur may be formed, when it is stated that the summit of the great trochanter projected fully one inch above the

upper border of the acetabulum. Nothing is known of the history of the case; but, judging from the completeness of the reparation, the accident must have occurred many years before death. Some degree of motion, certainly very slight, must have existed both in the acetabulum, and at the junction of the two fragments, the upper end of the lower of which was converted into a socket into which the lower end of the upper was received, a kind of adventitious membrane having been interposed between the contiguous surfaces.

In the *treatment* of this fracture, one important point is not to pull the ends of the broken bone asunder in our attempts to examine the case. Hence, whenever impaction is suspected, the rule is to refrain from all rotation and extension. The nature of the accident being properly diagnosed, the limb is to be placed in an easy position in bed, a pillow lying under the ham, and gentle, but steady pressure being made, by means of a compress and bandage, in the direction of the great trochanter, with a view of rectifying any deformity that may exist in that situation. Generally, no splint will be required, and in ordinary cases the patient will be able to move about on crutches in three or four weeks.

*General Diagnosis.*—Fractures of the neck of the thigh-bone are liable to be mistaken for other lesions, and it becomes, therefore, a matter of importance to the practitioner to have accurate conceptions of their real nature, errors of diagnosis here being always particularly prejudicial, both to the patient and the practitioner. The affections with which they are most apt to be confounded are sprains and dislocations of the hip-joint, and, in many cases, great difficulty is also experienced in deciding whether the injury is one of fracture within the capsular ligament, or of fracture exterior to it.

The symptoms of fracture of the neck of the femur, especially the intra-capsular, are sometimes closely simulated by sprains and contusions of the hip, causing involuntary obliquity of the pelvis with apparent shortening of the limb, and eversion of the knee and foot, along with excessive pain and difficulty of motion. The resemblance is occasionally so perplexing as to create doubt in the mind of the most skilful diagnostician, and, among the less informed, has often led to the most serious errors of practice, by the employment of harsh means where the most mild and soothing alone were necessary. The signs of distinction are the following: 1. In fracture the shortening is real, and can be effaced only by extension and counter-extension; in sprains and contusions, on the contrary, it is not real, but apparent, as may be proved by placing the limbs parallel with each other, and bringing the two iliac crests on the same level. 2. In fracture the eversion of the foot is complete, the extremity presenting an appearance characteristic of total loss of power; in ordinary injuries of the hip and upper part of the thigh, the eversion is comparatively slight, and the patient can, in general, rectify it by his own efforts, although they may be productive of severe distress. 3. In fracture there is usually complete abolition of muscular action; so that the thigh can neither be flexed, extended, nor rotated, however determined the attempt. It is only in the impacted fracture that the individual has

still some control over the limb, and then the best guide for avoiding mistake is the existence of actual shortening. In sprains and contusions motion is diminished, perhaps very greatly, but not abolished.

One would suppose, at first sight, that it would be very difficult, even for an inexperienced practitioner, to mistake a fracture of the neck of the thigh-bones for a dislocation of its head upon the dorsal surface of the ilium, yet numerous cases are upon record testifying not only to the possibility of such an accident, but to its actual occurrence in the hands of distinguished surgeons. The only way to avoid error is to remember clearly the most prominent signs of each lesion. The subjoined tabular arrangement will serve to place the subject in its proper light, at the same time rendering a comparison of these symptoms an easy task:—

#### INTRA-CAPSULAR FRACTURE.

1. Occurs nearly always in old persons.
2. Is most common in women.
3. Usually the result of slight causes.
4. The foot is strongly everted.
5. There is great shortening, readily effaceable by extension and counter-extension, but recurring the moment the force is discontinued.
6. Marked crepitation exists.
7. There is preternatural mobility, the ends of the fragments being movable upon each other.

#### ILIAC DISLOCATION.

1. Is most common in adult and middle life.
2. Occurs with equal frequency in both sexes.
3. Always produced by severe force.
4. The foot is inverted.
5. The shortening is also great, but can be effaced only by restoring the bone to its natural position, when it will not return.
6. There is no crepitation.
7. The bone is in a fixed and constrained position.

But the greatest difficulty in the diagnosis of these affections of the thigh and hip arises from the embarrassment which the surgeon experiences in determining whether the case be one of intra-capsular fracture, or fracture exterior to the capsular ligament. As the subject is one of great practical consequence, it deserves to be studied with unusual care; and I shall, therefore, arrange the principal points in tabular form:—

#### INTRA-CAPSULAR FRACTURE.

1. The shortening, slight at first, generally not exceeding a third or half an inch, gradually increases to two inches and upwards.
2. The crepitation is indistinct, and can only be fully elicited by extension and counter-extension.
3. Function is much impaired, but not wholly abolished.
4. The great trochanter, on rotating the limb, moves, as it were, upon a pivot.
5. The pain is unreliable, both as it respects site and intensity, being generally most severe at the upper and inner part of the thigh, in the direction of the small trochanter.
6. There is generally little or no contusion, swelling, or discoloration.

#### EXTRA-CAPSULAR FRACTURE.

1. The shortening is as great immediately after the accident as it is at any time afterwards, and its extent also is usually less than in the intra-capsular fracture.
2. Is uncommonly distinct, being often loud and ringing, and is readily perceived on laying the hand on the trochanter and rotating the limb.
3. The loss of power is complete, the limb lying in a helpless, paralyzed condition.
4. It is often partially separated from the shaft of the bone, and then but imperfectly obeys the movements of the limb.
5. Also unreliable, but generally very severe, especially on manipulation or motion, and seated more in the direction of the great trochanter.
6. Usually severe contusion, with considerable swelling, ecchymosis, and discoloration.



Nothing of any diagnostic value can be deduced from a consideration of the age at which these two fractures occur, since, as was previously stated, both are met with almost exclusively after the fiftieth year, there being only a few well authenticated cases on record of its occurrence prior to that period. The same is true in relation to sex, experience having shown that this exercises much less influence upon the production of these two varieties of fracture than was formerly imagined. I am inclined, from a careful study of the subject, to place more reliance, in this respect, upon the existence of severe external injury, as contusion, swelling, and ecchymosis, and upon the presence of shortening, than upon any other phenomena. In the intra-capsular fracture, the external signs of injury are certainly, as a general rule, exceedingly slight, while the reverse is usually the case in the extra-capsular, the parts being nearly always much bruised and discolored. In regard to shortening, it possesses, I think, great value as a diagnostic of the two lesions; for it may be assumed, on the one hand, that when it is very slight immediately after the receipt of the injury, and gradually increases afterwards, it depends upon intra-capsular fracture; and, on the other, that when it is very considerable immediately after the accident, it is caused by extra-capsular fracture. Rodet, who studied the subject with much attention, arrived at the conclusion that every fracture of the neck of the femur, produced by a fall or blow upon the great trochanter, was of an extra-capsular nature; whereas, every one occasioned by a fall upon the feet, or by muscular action, must be seated within the ligament. This conclusion, however, is altogether unfounded; in adopting it we should be compelled to assume that all intra-capsular fractures are the result of falls upon the feet, when all experience teaches that they are almost invariably produced by force applied directly to the hip.

The most important diagnostic characters of the *impacted* fracture of the neck of the femur, whether within or without the capsule, are, as has already been stated, shortening of the limb, the absence of crepitation, and the comparative or complete immobility of the fragments. The shortening is always immediate, and remains permanent in its original degree, unless the ends of the bone are rudely drawn asunder; hence it is a sign of an unequivocal character; the absence of crepitus is also very significant, and the trivial mobility, or complete absence of motion, is another circumstance of importance. The great danger in such a case is that the fracture may be mistaken for a dislocation; but from this it may usually be readily distinguished by a careful study of its history, and a thorough examination and comparison of the symptoms characteristic of the two lesions.

#### FRACTURES OF THE GREAT TROCHANTER.

Fracture of this bony apophysis may take place as an independent lesion, or as a concomitant of fracture of the neck of the femur, outside of the capsular ligament, as mentioned previously, and as exhibited in the annexed cut (fig. 144), from a specimen in my collection. As an independent fracture, it is very infrequent in comparison with the

other variety. It may occur at any period of life, but is chiefly observed in elderly subjects, as a consequence of direct violence, as a fall, blow, or kick, breaking off the trochanter in an oblique direction from above downwards. The fracture is sometimes comminuted, the trochanter being broken into several pieces, of irregular size and shape, the fragments grating under the fingers like a number of pieces of china. It may also be compound, although, in general, it is unaccompanied by any wound of the soft parts.

Fig. 144.



The *symptoms* of fracture of the great trochanter are generally well marked, the most important consisting in eversion of the limb, with separation of the fragments, inability on the part of the patient to sit down, and difficulty of obtaining crepitation. The eversion is unusually distinct, and is probably due, at least in great degree, to the loss of power in the external rotator muscles; the limb lies in a helpless condition, and no effort that the patient can make can change

its position. The broken trochanter is commonly widely separated from the shaft of the bone, and hence the difficulty which is generally experienced in eliciting crepitus, this being only practicable by placing the parts in apposition with each other. The displacement is either upwards towards the ilium, or downwards towards the tuberosity of the ischium, the former being the more frequent. When the patient attempts to sit down he is completely foiled, and immediately experiences great increase of pain, compelling him to desist. Most authors speak of shortening of the limb as a symptom of this fracture, but if shortening really exist, it can only be in a very slight degree. More or less contusion and ecchymosis of the soft parts are usually present.

The *diagnostic* signs are the eversion of the limb, the loss of prominence at the natural site of the trochanter, the fixed position of the small fragment on moving the shaft of the femur, and crepitus on approximation of the broken ends.

The *union* of this fracture is by osseous matter, and unless the bone is comminuted, a cure may reasonably be expected without any deformity of the hip or impairment of the functions of the limb. Considerable difficulty, however, is generally experienced in maintaining apposition of the fragments, and hence such an injury always requires more than ordinary vigilance on the part of the attendant.

The *treatment* consists in maintaining the limb in a perfect state of quietude by means of two long splints, the foot being supported in a perpendicular direction, with a slight tendency to eversion, which is the most natural position for a person when he lies on his back, and, therefore, the most eligible for relaxing the external rotator muscles when there is a fracture of the trochanter. The broken trochanter,

being drawn into its natural situation, is confined there by a soft leather belt, long enough to extend round the pelvis, and furnished with a sort of hollow pad, from three to four inches in diameter, for the purpose of embracing more effectually the prominence of the hip. Hardly any extension will be necessary. If the soft parts are much contused, leeches and fomentations should be applied before putting on the permanent dressings. After the patient has been confined for a month, he may be permitted to exercise on crutches.

The great trochanter is occasionally detached from the neck and shaft of the femur, in consequence of the forcible laceration of the fibro-cartilage by which it is connected to these parts during its *epiphyseal* state in early life, before the completion of the process of ossification. The accident, which is one of uncommon occurrence, is usually produced by a severe fall upon the hip, and is always extremely difficult of diagnosis, owing to the fact that there is seldom much, if any, appreciable displacement. In most of the recorded cases there has been much diversity in the symptoms; in some, the patient was able to walk immediately after the accident, while in others he had lost all control over the muscles of his limb; in some, the foot was everted, while in others it preserved its natural position, or was even inverted; in all there was severe pain, with considerable swelling, either alone or conjoined with ecchymosis, at the site of injury, and, during their progress, more or less constitutional disturbance.

The best manner of determining the diagnosis, in this accident, is to make the patient lie on his back and incline the pelvis over the injured side, while the affected limb is thoroughly abducted, or carried away from the sound one. The gluteo-femoral muscles being thus completely relaxed, the trochanter, if detached, may easily be pushed into its natural position, and crepitation elicited by rubbing it against the neck and shaft of the femur.

The occurrence of this accident is not without danger, several cases having been recorded in which it proved fatal, death having been caused by extensive suppuration and constitutional disturbance. When recovery takes place, the limb remains for a long time weak and painful. The union, under such circumstances, is fibro-cartilaginous, or partly cartilaginous and partly osseous. The treatment must be conducted upon the same principles as in ordinary fracture of the trochanter.



## CHAPTER II.

## INJURIES AND DISEASES OF THE HEAD.

INJURIES of the head have at all times been objects of the deepest interest and study with the surgeon. Independently of the frequency of their occurrence, they merit the greatest attention, on account of the obscurity of their diagnosis, the stealthy character of their progress, the difficulty of their management, and the uncertainty of their termination. It was remarked, long ago, by Mr. Pott, and the observation has been verified a thousand times since, that there is no lesion of the head so trifling, on the one hand, as not to endanger life, or so severe, on the other, as not to be followed by recovery. But these affections are interesting on another account. Notwithstanding the vast amount that has been written respecting them, there are numerous points, both as it regards their diagnosis, pathology, and treatment, which are hardly any better understood now than they were centuries ago, and which, therefore, require farther and more extended observation than they have yet received, before they can be considered as being fully settled.

## SECT. I.—LESIONS OF THE SCALP.

## 1. WOUNDS.

Wounds of the scalp exhibit the same general features as wounds in other regions. Thus, they may be simple, or complicated, incised, lacerated, punctured, contused or gunshot, superficial or deep. The only real difference is that they are more liable to be followed by erysipelas, inflammation of the brain, neuralgia, and certain nervous symptoms, which are often as perplexing to the practitioner as they are distressing to the patient.

*Incised wounds*, whatever may be their extent or depth, should always be treated with reference to the production of immediate reunion. With this view, as soon as they have been divested of blood and foreign matter, their edges should be carefully approximated with a suitable number of twisted sutures, care being taken to carry the ligatures from one needle to the other, so as to obviate the necessity for the application of adhesive plaster, which, while it always adheres badly, and never can be used without extensive shaving of the scalp, very frequently predisposes to the occurrence of erysipelas. When the cut is very slight, contact may often be effectually maintained by tying

together at their base a few little locks of hair on each side of it; the threads should be very fine, and be well waxed, otherwise it will be difficult for them to retain their hold until the adhesive process is sufficiently advanced to admit of their removal. When the wound is very large, the scalp should always be well shaved, as a preliminary step, but under opposite circumstances such a precaution will, in general, be entirely unnecessary.

It is difficult, at this day, to conceive why so much opposition should have been made in former times to the use of sutures in wounds of the scalp. In reading the accounts of some of the older surgeons of this mode of treatment, one is almost tempted to conclude that they must have thought that there was something peculiarly poisonous in it; a violent war was waged against it for nearly half a century, and it is questionable whether its influence has yet altogether disappeared. However this may be, it cannot be doubted that sutures of the scalp, in whatever form they may be used, are as harmless as any mode of dressing, of which it is possible to form any conception. If they were formerly a source of irritation, a circumstance which can hardly be denied, the occurrence was in all probability due to the coarseness of their material, and the manner of their introduction. These objections certainly do not exist at the present day, and no one who has once tried them in this situation will ever be likely to dispense with them. These remarks are particularly applicable to the twisted suture, which, in addition to the benefit already ascribed to it, has the advantage of compressing the orifices of the divided vessels, and of thus effectually controlling hemorrhage. It has occurred to me again and again to see the edges of a wound in the scalp, approximated simply with adhesive plaster, forced apart, and prevented from uniting, by the interposition of coagulated blood. When the twisted suture is properly made, no other dressing whatever is needed; the part is constantly exposed to view, and the moment any change of an untoward character arises it is detected, which it cannot be when the ordinary retentive means are employed. The sutures should not be withdrawn before the fourth or fifth day.

*Lacerated wounds* of the scalp are generally caused by blows or falls on the head, or by the passage of the wheel of a carriage. One of the most severe and extensive injuries of this kind which I have ever witnessed was inflicted by the horns of an infuriated cow. Owing to the manner in which they are produced, more or less foreign matter is usually entangled in these wounds, and for the same reason they are often followed by violent inflammation, suppuration, and even gangrene. The rule of treatment is the same as in incised wounds, but special care should be taken not to draw the edges so firmly together, lest the resulting swelling, which will always be considerable, should induce undue tension, and thus necessitate the premature detachment of the sutures. The scalp, too, should always be pretty extensively shaved, and cold water-dressing should be freely used, to prevent the untoward occurrences adverted to. With proper attention, it is surprising how much of the wound may, even in apparently the most unpromising cases of this kind, unite by the first intention.

A *punctured wound* of the scalp, apart from its tendency to erysipelas and suppuration, is usually a very simple affair. The proper remedy is the cold water-dressing, simple or medicated; and, if inflammation run high, the application of leeches, followed by emollient poultices. If matter form, or even if there be merely severe tension, appropriate incisions are made.

In *contused wounds*, the rule is, after thorough shaving of the scalp, and the removal of foreign matter, to approximate the edges very lightly with the interrupted suture, aided, if necessary, by a few strips of adhesive plaster. Proper allowance is made at the start for swelling and tension, which are often severe. If the edges are shreddy, or tattered, they are neatly trimmed with the scissors, but in no case should any flaps, even if violently bruised and apparently dead, be cut off; for no one can ever positively determine, beforehand, whether such a part is really deprived of vitality or not, and it is best, therefore, always to afford nature an opportunity of saving all she can. The leading indication is to circumscribe inflammation, and the best remedy for meeting it is the warm water-dressing, rendered slightly stimulating by the addition of a small quantity of laudanum, alcohol, or spirits of camphor. In this way an attempt is made to impart tone to the contused vessels and nerves, to enable them more effectually to withstand the effects of inordinate action. Pencilling the surface immediately around the wound with a weak solution of iodine or nitrate of silver is sometimes beneficial.

*Gunshot wounds* of the scalp, which are very rare in civil practice, demand the same treatment as similar injuries in other parts of the body. When the ball lodges, immediate extraction is effected, any foreign substance that may have entered along with it being removed at the same time. Such wounds often require dilatation and counter-opening, to give vent to effused fluids.

## 2. CONTUSIONS.

Contusions of the scalp, properly so termed, present themselves in various degrees, from the slightest bruise, as it is vulgarly called, to a mashed, softened, and pulpified condition of its component elements. They may be superficial or deep-seated, circumscribed or diffused, simple or complicated. Their tendency, even when slight, is to terminate in violent inflammation, especially of the erysipelatous variety, in abscess, and even in gangrene. Such events will, of course, be most likely to happen in persons of intemperate habits, or of a broken-down constitution, though the most healthy individuals do not always, indeed, perhaps, not generally, escape them. Another effect of a severe contusion of the scalp is its liability to produce mischief in the brain and its membranes. Two circumstances suggest themselves as likely to bring about this state of things. The first is the shock sustained by the cranial contents by the violence of the blow inflicting the contusion, and the other, the disposition in the resulting inflammation to extend to the meninges through the vessels and fibres of the pericranium. Accidents of this kind are occasionally complicated with



fracture of the skull, detachment of the dura mater, or concussion of the brain. Sometimes, again, a portion of bone is merely bruised, and yet the action consequent upon the lesion is so great as ultimately to cause its death. When the contusion is at all severe, there is usually a considerable effusion of blood, presenting itself generally in the form of a circumscribed tumor; in rare cases the blood is widely diffused, extending, in fact, nearly over the whole head.

The *secondary effects* of these accidents should not be overlooked. These consist, for the most part, of certain nervous symptoms, as numbness of the scalp, partial paralysis of the face, headache, muscular twitchings, strabismus, and neuralgic pains. Occasionally the scalp remains very tender at one particular point, a spot perhaps not larger than half a dime, so that the patient is unable to bear the slightest pressure of the finger, or even of his hat. Finally, these contusions are at times followed by epilepsy, abscess of the liver, and atrophy of the testes.

Contusions of the scalp, however slight, should always, for the reasons above mentioned, be regarded as accidents of serious import. The patient should be cautioned about his diet; the bowels should be properly regulated, and he should avoid premature exposure. Under this management, the affected parts will generally, in a very short time, be restored to their pristine condition, without, perhaps, the slightest topical medication, or, at all events, without anything else than cold water, or some mildly astringent lotion. When the injury is more extensive, the warm water-dressing should be used, and its efficacy will usually be much increased by the addition of opium and hydrochlorate of ammonia, alcohol, or spirits of camphor. These ingredients are particularly valuable in such cases, not only by imparting tone to the affected tissues, but by promoting the absorption of extravasated blood, and should seldom be dispensed with. Warm applications are nearly always borne better, both by the scalp and the system at large, than cold, whether simple or medicated, and they are also much less likely to cause injurious metastasis to the brain and its membranes. In regard to this matter, however, the practitioner will always do well to consult the feelings of his patient. When the inflammation is at all severe, leeches will be demanded, especially if there be impending cerebral involvement, and they should be profusely scattered over the affected surface. Tension and swelling must be remedied by multiple punctures; and, if abscesses form, they must be opened early and freely, to relieve pain and prevent destructive diffusion of the pus.

The secondary lesions of the scalp must be treated upon general principles; by incision, and a profuse discharge of matter, if there be great tenderness, of a circumscribed character, depending upon chronic thickening of the periosteum; by anti-neuralgic remedies, when the pain is periodical, or of a dull, heavy, aching character; and by emetics, purgatives, and a properly regulated diet, when there is disorder of the digestive organs, with irregular action of the muscles. The cold shower bath, change of air, and, in obstinate cases, slight but persistent pyalism, will be beneficial.

## 3. TUMORS.

The *sanguineous* tumor, as it is termed, is often met with on the scalp, generally as a consequence of blows, falls, kicks, and other injuries, the blood being extravasated into the subcutaneous cellular tissue, either in the form of a distinct swelling, or as an infiltration. The accident not unfrequently happens during parturition, from the pressure on the child's head in its descent through the soft parts of the mother. Contusions of the scalp, however slight, or however induced, are always followed by sanguineous effusion. The blood may be situated immediately beneath the skin, below the aponeurosis of the occipito-frontal muscle, or beneath the pericranium, in direct contact with the bone. Varying in quantity from a few drachms to several ounces, it is of a fluid, semi-fluid, or solid consistence, and of a dark purple color, according to the period at which it is examined, or the circumstances under which it is extravasated. The most abundant accumulations of this kind usually occur at the sides of the head and the superior part of the occiput, in consequence, apparently, of the greater laxity and vascularity of the tissues there than elsewhere. Immense bags of blood are occasionally formed in both these situations, especially after falls and blows on the head, attended with the laceration of some of the branches of the temporal and occipital arteries.

When the tissues of the scalp have been much contused, the extravasated blood will seldom be found to be fully coagulated, and occasionally, in fact, it is even completely fluid, having apparently been deprived of its vitality at the moment of the accident. The same thing usually happens when the collection is very large, although the parts may have suffered comparatively little violence. If the blood be permitted to remain for any length of time, it undergoes changes similar to those witnessed in an apoplectic effusion; that is, it loses its dark color and soft consistence, and is converted into a grayish, fibrinous mass, of varying firmness and density. On the other hand, it occasionally happens that all the solid matter is absorbed, and that all that remains is a pale serous, or oily-looking fluid. During the inflammation which supervenes upon these accidents pus is sometimes poured out, and, mingling with the blood, imparts to it its peculiar appearance.

The tumor formed by the extravasated blood is either circumscribed and of a rounded, or conical shape, or it is diffused and irregular, being, perhaps, flattened at one point, and elevated at another. It is always soft and fluctuating at the beginning, and sometimes it even retains this feature throughout, though in most cases it soon becomes comparatively hard and firm, from the coagulation of its contents. When it is caused by external violence, as a blow or fall, it has occasionally a sharp, abrupt, and well-defined margin, and the finger, as it sinks into the centre of the swelling, receives an impression as if there were a fracture of the skull with depression of the bone, although nothing of the kind is present. The appearance of the skin is variable; but, in general, it is unchanged, being neither discolored, ecchymosed, nor oedematous. When inflammation arises, the tumor becomes hot, tender, and pain-

ful. In cases of long standing, the blood is sometimes surrounded by a distinct cyst, and in the sub-pericranial form of the affection the uplifted membrane has been known to undergo extensive ossification.

Accumulations of blood of the scalp, whether circumscribed or diffused, usually disappear, either spontaneously, or under very simple treatment, as refrigerant, astringent, and sorbefacient lotions, tincture of iodine, blisters, and leeches, the two latter being particularly indicated when the tumor is hot and inflamed. Mild purgatives will often be useful, and proper attention must be paid to the diet. In children, a very convenient and efficient remedy is a weak solution of hydrochlorate of ammonia in equal parts of vinegar and water. When the case proves troublesome, as it will be liable to do when the blood is profuse, deep-seated, or deprived of vitality, subcutaneous evacuation will be necessary, followed by systematic compression.

Various other kinds of tumors are liable to form on the scalp. The most common, according to my observation, are the *sebaceous*, described in a former chapter, which sometimes exist in considerable numbers. They are easily removed by incision and enucleation.

The *fibrous* tumor is sometimes met with in this situation. Such a growth, removed by Professor Pancoast, at the College Clinic, in 1858, by means of the *écraseur*, is represented in the annexed cut (fig. 145). The patient was an elderly man; and the tumor, which occupied the vertex, and was of the volume of a large orange, had been of several years' standing. Its summit had been invaded by ulceration.

Various kinds of *vascular* tumors, arterial, venous, or arterio-venous, are liable to form on the scalp, and may in time acquire a large bulk and a very formidable character. Riddance should be effected as early as possible.

The cranial bones now and then suffer from *exostosis*; the occurrence, however, is rare, and the growth does not exhibit anything unusual in its structure except that it is generally very hard and dense.

*Malignant* tumors of the scalp are infrequent. The most common form is the epithelial, or exedent lupus, which, in its progress, sometimes involves the cranial bones.

Surgical interference with tumors of the scalp should never be attempted without due preparation of the system, as it is extremely liable to be followed by erysipelas and other bad effects, jeoparding life.

Fig. 145.





## SECT. II.—CONCUSSION OF THE BRAIN.

Concussion of the brain has been variously defined by different writers, hardly any two agreeing in regard to it. The most common idea appears to be that it is a commotion of the nervous fibres, inducing a change, vague and indefinable, in the relations which they sustain to each other and to their vessels. How far such a view is worthy of adoption it is not easy to determine; for it is very certain that, notwithstanding all that has been said upon the subject from the earliest period of medicine down to the present, the progress of science has failed to afford us any substantial light respecting the true mechanism of this occurrence. The modern pathologist, in surveying this interesting and important topic, finds that he has no reason to pride himself upon his knowledge; if he attempts to penetrate beyond the trodden paths of his predecessors, doubts and difficulties meet him at every turn, and soon compel him to retrace his steps.

If we reflect upon the pulpy structure of the brain, it is surprising that any one should ever have seriously entertained the idea that, during concussion, this organ experienced a diminution of size, from the condensation of its constituents. Such an explanation is certainly not well calculated to give us very correct conceptions of the nature of this lesion. Accurately filling the cranial cavity, it is impossible that the brain could undergo any change of bulk from a mere commotion of its substance. A decrease of size can only be produced by the slow action of the absorbents, not suddenly, but gradually, in a manner altogether irreconcilable with the production of concussion. The theory of an increase of bulk of the organ is equally absurd, inasmuch as such an occurrence can only take place in consequence either of extravasation of blood or of inflammatory exudation. The only idea that I can form of the nature of the injury is that it is caused by the jarring of the nervous substance, eventuating, at least in severe cases, in a loss of its consistence, if not in its positive laceration. To show how plausible this view is, it is only necessary to inquire into the character of the exciting causes of concussion. In general, the accident is produced by direct violence, as a blow or fall upon the head. Now, when this happens, it is easy to perceive how the brain is influenced by the vibratory movements which are communicated to it by the osseous case which incloses it. The force of the injury, instead of being expended upon the skull, is transmitted to the cerebral substance, which it jars very much as a bow may be supposed to be jarred in discharging an arrow. When the blow is slight, the effect will be proportionably mild, the patient being, perhaps, merely stunned; but when the force is severe or concentrated, the result will be different, the substance of the brain being not only shaken but, it may be, even lacerated, the lesion exhibiting itself in the form of a fissure, which becomes immediately filled with blood, from the rupture of the small vessels.

Similar effects occur when the concussion takes place in consequence of violence applied indirectly, as when a person, falling from a consid-

erable height, alights upon his feet, knees, or buttocks. Here the force of the injury is transmitted along the bones of the extremities and of the spine to the base of the skull, where, exploding, it is communicated to the brain, very much in the same manner as when the head is struck with a hard body, as a bludgeon, poker, or brick. The effect of this form of concussion may be illustrated by what occurs in the boyish amusement of killing woodpeckers in countries where cherries abound. To prevent the depredations of these marauders, a slender pole is sunk into the earth, its head protruding at the top of the tree. When the bird alights, the pole is struck with an axe, and the vibratory motion thus transmitted through the pole to his body, kills him in an instant. Now, in this case, death is caused, not by any change of bulk in the brain, nor by any alteration in its consistence, but simply by the jarring of its substance, disqualifying it for the transmission of the vital fluid, and, consequently, also for the maintenance of its circulation.

*Dissection* unfortunately has thrown little, if any, positive light upon the nature of concussion. All that the knife has revealed in the examination of those who have perished from the immediate effects of the accident is of a negative character. The most minute inspection, both with and without glasses, has failed, in ordinary cases, to detect the slightest lesion of the cerebral tissues. Even in the worst forms, those which are associated with compression, the most that has been found has been a laceration, commonly sufficiently insignificant, of some portion of the organ, attended, perhaps, with a trifling extravasation of blood. Sometimes, as when the rent has been more extensive, involving, it may be, the surface of the hemispheres, or the lateral ventricles, the effusion has been more considerable, but such an event constitutes the exception and not the rule.

As concussion of the brain may exist in various degrees, so the *symptoms* which characterize it may present various shades of difference, depending upon the severity of the injury; hence it will be proper to study these symptoms with reference to their diagnostic and therapeutic value. It will greatly facilitate the comprehension of the subject if we adopt the division of concussion into the three stages of collapse, reaction, and inflammation, usually recognized by writers and teachers; for, although such an arrangement is altogether arbitrary, and, therefore, unnatural, yet something of the kind is absolutely necessary for the sake of clearness of description.

1. The stage of *collapse* is characterized by symptoms of exhaustion, not unlike those produced by the loss of blood. The system has received a shock, varying from the slightest functional disturbance to complete insensibility, life being suspended, as it were, merely by a feeble thread. In the former case there is, perhaps, only slight pallor of the countenance, a confusion of ideas, a disposition to yawn, and a feeling of nausea. The patient rubs his eyes, stares wildly around, and possibly vomits; but, presently recovering his consciousness, he gets up, and goes about his business as if little or nothing had occurred. This is an example of slight concussion, such as happens when a man is pitched gently off a horse, thrown out of his carriage, or struck upon the head. When the lesion exists in a more aggravated degree,

these symptoms will not only be much more distinctly marked, but of longer duration, a number of hours, perhaps, elapsing before reaction will set in. The prostration is profound; the countenance is of a deadly pallor; the breathing is almost extinct; the pulse is soft, feeble, and intermittent, sometimes hardly perceptible; the loss of strength is complete; deglutition is impossible; the stomach, oppressed with nausea, perhaps lazily ejects its contents; the bowels are relaxed, and there are occasionally involuntary discharges; the pupils are usually contracted and still somewhat sensible to light, or one is diminished and the other dilated, or, finally, one is contracted and the other natural; special sensation is in a state of abeyance; the mind is prostrated; and the patient, roused with difficulty, answers, if spoken to, in a drawling monosyllable. The surface of the body soon becomes cold, and is often bathed with perspiration. The condition of the bladder varies; in general the urine dribbles away involuntarily, but sometimes it is retained, and requires to be drawn off with the catheter.

The duration of this stage varies from a few minutes to several hours or even days, depending upon the extent and severity of the lesion. When the functional disturbance is slight, it may last only a very short time, but, under opposite circumstances, the prostration will be more persistent, and sinking may occur, without any effort at reaction.

The symptoms of collapse from concussion are sometimes painfully simulated by those of intoxication, or it may be that the two affections co-exist, thus increasing the embarrassment. The diagnosis is to be deduced from the history of the case, the presence of external injury, particularly upon the scalp, the habits of the patient, and the state of the breath, which, in inebriation, will be alcoholic in its character. When doubt exists, the proper plan is to treat the case as one of concussion, endeavoring, by the means to be presently mentioned, to bring on gradual reaction. A few hours will generally suffice to reveal the true nature of the affection, and this interval is not spent idly by the surgeon, but in a thorough examination of the body, with a view to the prompt detection and rectification of other injuries.

The leading indication in the stage of collapse is to establish reaction, or to rouse the enfeebled and, perhaps, flagging energies of life. This object may usually be attained by very simple means, promptly and judiciously exercised. The first thing to be done is to place the patient recumbent with his head on a level with the body, or, if the symptoms be at all urgent, even considerably lower, in order that the heart, exhausted by the shock, may be enabled to throw the blood with more facility to the exhausted brain. A free access of air is next procured, by opening the doors and windows of the apartment, and by the active use of the fan. If there be any bystanders, or idle spectators, they must immediately be sent away, as their presence cannot fail to be prejudicial to the patient. Any tight garments, especially the collar and pantaloons, must promptly be relaxed, to give full play to the respiratory muscles. Cold water is freely dashed upon the face and chest, smelling bottles are held *near* the nose, not steadily, but intermittently, and sinapisms are applied to the ex-



tremities and the precordial region. In the milder forms of concussion, these means are generally amply sufficient for the speedy establishment of reaction; but when the case is very severe it may be necessary, in addition, to place sinapisms along the whole length of the spine, and to employ stimulating injections, as water impregnated with mustard, common salt, brandy, or spirits of hartshorn. If the feet are cold, they may be immersed in warm water, or rubbed with hot cloths, and afterwards wrapped up in warm flannel. As soon as the patient is able to swallow, he may take a little cold water, or water and spirits, the latter being more especially indicated when the system is long in showing signs of reaction. Spontaneous vomiting sometimes greatly promotes restoration, particularly if a hearty meal was taken shortly before the occurrence of the accident; a heavy load being thus removed, the diaphragm enjoys greater play, and the pneumogastric nerves act with increased vigor.

As life returns, color succeeds pallor, warmth coldness, and intelligence confusion of ideas; the pulse resumes its wonted force and activity, the respiration becomes more natural, the stomach is relieved of nausea, the sphincters recover their proper functions, the special senses are again on the alert, and volition is exercised with its proper freedom. The restoration may be rapid or gradual, temporary or permanent; but once fully established, it rarely recedes, but, on the contrary, steadily advances, with a tendency, not unfrequently, to over-action.

In treating concussion of the brain, the young practitioner is apt to be led into several serious errors, especially if he is surrounded by officious by-standers, and not perfectly self-possessioned.

1st. He may be foolish enough to draw blood, or, at all events, to attempt to draw blood while his patient is in a state of profound exhaustion, unable, perhaps, to crook a finger or utter a syllable. Nothing is more common immediately after such accidents than for the friends of the patient to insist upon his being bled; and if the practitioner, in an unguarded moment, yields to the silly request, he may destroy life on the instant, or render the reaction a matter of great difficulty, if not of impossibility. To bleed a man in such a condition would be as absurd and culpable as to bleed him when he is in a state of syncope from the loss of blood.

2d. Great care should be taken in the use of ammonia, and other pungent articles, not to hold them too near the nose, lest they induce spasm of the glottis, and thus suffocate the patient. Moreover, their employment may give rise to inflammation of the nares, fauces, larynx, and trachea.

3d. The practice of pouring drinks into the patient's mouth, before he is able to swallow, cannot be too pointedly condemned. It is fraught with great danger, on account of the liability of the fluid to pass into the windpipe, where even a small quantity might induce suffocation. The patient should, therefore, be sufficiently conscious to know what is being done to him, or, if this is not the case, the fluid should be placed in contact with the fauces, beyond the reach of the larynx, it being well known that the act of swallowing will be excited, under such circumstances, by adopting this procedure.

4th. When stimulants are used, due regard must be had to their quality and quantity, as well as to the period of their administration. Brandy, as a general rule, is preferable to anything else, but it should be given sparingly, and be suspended the moment reaction has fairly commenced. The object is to rouse the system gradually, not rapidly, to coax, not to force, the jaded powers of life; this wish attained, all artificial excitants are refrained from. In ordinary cases no internal stimulants whatever are required.

5th. The accident may have occurred soon after a hearty meal, and then the question may arise in regard to the propriety of an emetic. Nature sometimes decides this for the practitioner, by the institution of spontaneous vomiting; but when this is not the case, and there is no contra-indication, as there will be when the concussion is complicated with compression, it may be excited by salt and mustard, ipecacuanha, or sulphate of zinc, aided by large draughts of tepid water. During the act of emesis, whether occurring spontaneously, or induced artificially, the patient should lie with his head inclined forwards, otherwise some of the ingesta, as they are lazily ejected, may drop into the air passages, and so cause fatal asphyxia.

2. *Reaction* being established, the surgeon's duty plainly is, not to fold his arms idly, on the one hand, nor to be over-officious, on the other. His business is to stand as a guard over his patient, carefully watching, and measuring, as it were, every symptom as it arises, in order, if possible, to form a just appreciation of its pathological import, and to seize the earliest moment to counteract any aberration from the healthy action. The great danger now is from inflammation of the brain. Usually, after the patient has completely regained his faculties, it is observed that the functions which were suspended are performed with a slight degree of excitement; but this is not to be taken as an evidence for active interference; on the contrary, it generally disappears spontaneously in a few hours, the surface becoming moist, and the pulse losing its sharpness and frequency. The diet is light and non-stimulant, perfect quietude of mind and body is enjoined, and the bowels are moved by gentle laxatives. If the shock has been at all severe, the patient is warned against premature exposure, even if the symptoms have happily passed off; he must consider himself as an invalid for weeks, and avoid everything calculated to awaken excitement in the recently shattered organ, now peculiarly prone to take on morbid action from the slightest causes. The head must be sedulously watched, and any pain of which it may be the seat, must be looked upon with suspicion, especially if it be combined with irritable temper, vitiated appetite, and a sharp, frequent pulse. A brisk purgative, and a few leeches to the temple, or the abstraction of a little blood from the arm, may avert the threatened evil, and prevent it from passing the natural limits, while the delay, even of a day, may enable it to reach a crisis which may speedily prove destructive to life.

3. *Over-action* of the system, consequent upon the cerebral lesion, constitutes the third stage of concussion. The period of its access is variable. In general, it comes on within the first four or five days, but cases not unfrequently occur where it is not developed for weeks and

months, the patient considering himself all the while out of danger, and fully competent to attend to his daily occupation. In the former case, the disease is usually bold and undisguised; in the latter, on the contrary, it is often latent, its approaches being slow and stealthy, and its progress, consequently, often considerable before its true nature is discovered. Such cases are always peculiarly dangerous, on account of their liability to be overlooked and mistreated.

*Inflammation of the brain*, as it ordinarily exhibits itself, is characterized by high febrile disturbance, intolerance of light and noise, cephalalgia, flushed countenance, suffusion of the eyes, vigilance, excessive thirst and restlessness, heat and dryness of the skin, hurried respiration, coated tongue, loss of appetite, constipation of the bowels, scanty and high colored urine, and a quick, hard, and frequent pulse. The mind begins to wander at an early period, and gradually muttering delirium, or maniacal excitement, sets in. As the disease advances, the patient is seized with spasm, and finally with coma, paralysis, and convulsions, which soon close the scene, life usually terminating in from three to six days. On dissection, the brain and its envelops are observed to be in a state of disease, portions of the former being softened, and seemingly mixed with blood and pus, and patches of the latter preternaturally vascular, and incrustated with lymph. Serum, often in considerable quantity, exists in the ventricles, at the base of the skull, and on the top of the hemispheres. The dura mater is usually free from disease, but the pia mater and arachnoid are almost always involved in the morbid action, as is evinced by the injected condition of the vessels of the former, and the opaque appearance of the substance of the latter.

In the *treatment* of this form of inflammation, the object is to assail the morbid action as early and as vigorously as possible. It will readily be understood that, in an organ so essential to life as this, there can be no hope of relief if the disease is permitted to obtain the slightest ascendancy. Few cases recover when structural lesion has taken place, or when there are inflammatory exudations. Hence, whatever is done must be done promptly and energetically. The treatment, too, is sufficiently simple. Blood is taken liberally from the arm and temples; the bowels are thoroughly evacuated with calomel and jalap, aided, if need be, by enemas; the head, shaved and elevated, is enveloped with a bladder partially filled with ice; light and noise are excluded from the apartment; and the patient is kept upon the smallest possible allowance of food, of the most bland and simple character. Cold water, simple or acidulated, constitutes the proper drink. After the first heat of the conflict is over, the same means are continued, but in a milder form, the antimonial and saline mixture with occasional leeching now taking the place of the lancet. Sleeplessness and jactitation are relieved by the cautious use of anodynes, combined, if there be dryness of the surface, with antimony. Counter-irritation is sometimes beneficial, but generally much less than has been supposed. My experience does not enable me to say anything in its favor. Vesication with croton oil rubbed behind the ears is, perhaps, the least objectionable mode; it is less painful than vesication of the nape of the neck,



and is, I think, quite as efficacious. Occasionally, especially when there is much delirium, a blister may be advantageously applied to the inner surface of the thigh. When effusion is threatened, or is already going on, mercury, in the form of calomel, or the protiodide, properly guarded with opium, and given in full doses, as three grains of the former, or one of the latter, every four hours, is indicated, and should be rapidly pushed to the extent of decided ptyalism. After the influence of the remedy has been fully established, iodide of potassium may be used as a substitute, to complete the cure, should nature and art be fortunate enough to accomplish it.

The more insidious form of inflammation of the brain, consequent upon concussion, is by no means uncommon, and is particularly dangerous, for the reason, as was previously mentioned, that it is so very liable to be overlooked at a period when alone treatment can be of any avail. The patient, after having suffered from this lesion, has perhaps made a very rapid recovery, and soon goes about his accustomed business, hardly thinking that anything has ailed him. This will be particularly apt to happen if the injury has been very slight, and the effect very transient. Under such circumstances, it may be quite impossible, with all the arguments that the practitioner can adduce, to persuade him to refrain from exercise and food even for a few days. He will not consider himself an invalid. He goes about his business, eats, drinks, and is merry. By and by, he begins to feel unwell; his head aches, his temper is easily disturbed, his appetite is capricious, his bowels do not act properly, his sleep is interrupted by unpleasant dreams, he has occasional fits of dizziness or vertigo, his pulse is too frequent, and he cannot apply himself with any satisfaction to his pursuits. Such is the usual prodrome of an event which has cost many a man his life. Mischievous mischief is stealthily going on in the brain, or in the brain and its membranes, which, if not promptly checked, will soon burst forth like the smothered flame of the incendiary's fire. In a little time the system is overwhelmed with excitement; soon delirium follows; then come coma and paralysis, and finally convulsions seal the sufferer's doom. Inspection reveals serious lesion of the brain and its envelops, with effusion of lymph and sero-purulent matter on the surface of the latter, and softening and perhaps abscess in the substance of the former.

The nature of this form of disease is, unfortunately, seldom recognized by the practitioner in time to afford his patient the necessary relief. He is generally disposed to make light of it, or it may be that he overlooks it altogether. When at length his suspicions are aroused, he finds to his horror that the case is utterly beyond the reach of his power. Effusion has taken place, and death is inevitable.

The treatment of this secondary affection does not differ materially from that of the primary. As soon as the symptoms begin to develop themselves, the patient must be restricted to the most scrupulous antiphlogistic regimen, and submit to active and steady purgation, with the liberal use of tartrate of antimony and potassa. If head-symptoms exist, blood is taken from the arm and temple, and counter-irritation is applied to the nape of the neck by seton, issue, or blister, its action

being much more advantageous here than in the acute form of the malady. The treatment is continued for some time after all disease has apparently vanished, the patient slowly returning to his former habits and occupation.

Other effects, some primary and some secondary, are liable to follow concussion of the brain. Among these, the most prominent are a sallow, icterode, and haggard state of the countenance, disturbed sleep and frightful dreams, pain in the head, dizziness, vertigo, loss of memory, partial deafness, impaired vision, contracted or dilated pupil, strabismus, difficulty of articulation, muscular twitchings, partial paralysis, nausea and vomiting, constipation of the bowels, irritability of the bladder, and gradual emaciation.

The loss of memory is among the most singular of these occurrences. It often exists in a remarkable degree, and may take place by itself or in association with other affections. Generally, it refers only to recent events, but in some instances it involves every circumstance in the history of the individual's life, past and present. The patient is sometimes unable to recollect his own name, the country of his birth, or his present residence. Sometimes, again, he is unable to connect his words, or to pronounce certain letters. Occasionally the mind is in a state bordering upon fatuity, or mental alienation. Epilepsy is another, though happily, a rare occurrence. Cases are met with in which the sexual powers are seriously impaired; sometimes temporarily, sometimes permanently.

What the pathology of these affections is is not known, as dissection has thus far failed to throw any light upon it. It may be supposed, in the absence of positive facts, that they are dependent upon local congestion, irritation, or inflammation of particular parts of the brain, or of the brain and its envelops, upon laceration of the cerebral substance, or upon the presence of extravasated blood, serum, or lymph.

The treatment must, of course, be in great measure empirical; but, however this may be, it should always be particularly directed to the head and alimentary canal, consisting mainly in local depletion, quietude of mind and body, the administration of purgatives, an occasional emetic, counter-irritation, especially of the pyogenic kind, and a careful regulation of the diet. A gentle course of mercury is sometimes beneficial, and in most cases signal advantage will accrue from moderate country exercise, tonics and the cold shower-bath, with dry friction.

### SEC. III.—COMPRESSION OF THE BRAIN.

It is hardly possible to give a more satisfactory definition of compression of the brain than of concussion. Every surgeon knows what import to attach to the expression, but to say what compression is, or how it is produced, are questions that have puzzled and perplexed many of the wisest men in the profession. The legitimate meaning of the term, and as it is generally understood, is that the cerebral substance is pressed, by some eccentric force, into an unnatural space, or, what is the same thing, that the natural volume of the part pressed

upon is diminished. But is this really the case? Is it possible to compress an organ composed of so pulpy a structure as the brain? I cannot myself conceive of such an occurrence, unless we take a portion of brain and subject it to an amount of artificial pressure such as is altogether inconsistent with what takes place even in the worst cases of compression within the skull. We can conceive how the different portions of the brain may be changed in their relations; how one part may be flattened and another part expanded in consequence; how, for instance, the convolutions of the hemispheres may be pressed out, and how their furrows may be effaced; how the lateral ventricles may be encroached upon, and even be obliterated; how the vessels of the brain may be flattened and destroyed; but we cannot, I repeat, conceive how the cerebral tissues can be so condensed and pressed together as to occupy less space than in the natural state. This view of the case, it seems to me, is the only one that is at all admissible, and hence, if we assume it to be correct, it follows that compression of the brain is merely a change of the relative position of the component portions of the organ, and not what the term really signifies in its etymological sense. Dissection affords daily proof of the correctness of this opinion. We sometimes see the greater part of a whole hemisphere flattened by an enormous coagulum, and yet, if the affected portion could be accurately measured, it would be found to occupy as much space as in the normal state, or as it did previously to the accident. The change is observed to depend mainly, if not exclusively, upon the depression of the convolutions and the effacement of the intervening spaces, and not upon any condensation of the cerebral tissues, or any actual reduction of their volume. The pressure exerted by the clot could not act in any other manner, because its force is not sufficient; nor is it possible for a piece of bone to cause any more efficient pressure, for the moment the force thus applied exceeds the force of the resistance, the brain gives way, and projects up beyond the edges of the depressed bone.

Compression of the brain may arise from various *causes*, but, surgically considered, they may all be referred to four classes: first, compression from extravasated blood; secondly, compression from depressed bone; thirdly, compression from effused pus; and fourthly, compression from the presence of a foreign body.

However induced, the *symptoms* of compression are always of the same character, and are generally easily recognized, as every organ of the body is affected by the cerebral disorder. The period of their appearance is influenced by the nature of the exciting cause. When the compression is dependent upon depression of bone, the symptoms are usually immediate, whereas in compression from extravasation of blood some little time often elapses, especially when there is great shock. In compression from effusion of matter, a number of days intervene between the occurrence of the injury and the appearance of the symptoms, the parts being obliged to pass through the several stages of inflammation before they can reach the suppurative crisis.

A person laboring under compression of the brain is deprived of sensibility and motion; he is unconscious of what is passing on around



him; if he is spoken to, he makes no reply, not even in a monosyllable; he cannot hear, nor see, nor taste, nor smell, nor has he any power to articulate, to swallow, or to protrude his tongue. His countenance is ghastly pale and withered; his eyes are turned up, glassy, and fixed; the lids are open and immovable; the pupils are widely dilated, and insensible to light; the breathing is slow, labored, stertorous, and performed with a peculiar whiff, or blowing sound; there is hemiplegia, or paralysis of the side opposite to the seat of injury, and, as a necessary consequence, the corner of the mouth is drawn over towards the sound side; the pulse is slow and oppressed; the stomach and bowels are torpid; and the bladder is incapable of expelling its contents.

These symptoms do not, of course, always exist in the same degree, nor are they all equally well marked in every case. The compressing cause being slight, the phenomena will be proportionably mild. Thus, the patient may be only partially insensible; his intelligence may be weakened, but not abolished; the special senses may still be able to perform their functions, although very imperfectly; the paralysis may be confined to one limb, or to certain muscles; the pupils, pulse, and respiration may be only slightly altered; the bowels may be torpid, but only in a moderate degree, and the bladder may still be able to expel a portion of its contents. If the foot be pinched the patient will moan, or draw the limb away, thus showing that he has still some feeling, if not motor power.

The paralysis which attends this affection is usually on the side opposite to that of the compressing agent, the occurrence being generally supposed to depend upon the decussation of the fibres at the base of the brain. This is doubtless true, but whether it be or not, the fact is of great practical importance in relation to the operations that may be required for the patient's relief. In a few instances, as inexplicable as they are rare, the paralysis exists on the same side as the cause of compression.

Much diversity obtains in respect to the state of the pupils. In general, they are observed to be widely dilated, but occasionally they are contracted, and cases occur in which one is contracted and the other dilated. A diminution of both pupils is extremely uncommon.

#### DIFFERENTIAL DIAGNOSIS OF CONCUSSION AND COMPRESSION.

If compression of the brain were always an uncomplicated affection, it would be difficult, if not impossible, to confound it with other diseases; but such, unfortunately, is not the case. Not unfrequently is it blended with concussion, the symptoms of the two lesions being so commingled as to render it doubtful to which they properly belong. As such an occurrence is always exceedingly embarrassing, and must, to a greater or less extent, influence the nature of the treatment, it is the duty of the surgeon to study the features of each complaint, in its more simple forms, so that, when he meets with them in combination, he may be the better able to discern their various shades of difference. The subjoined summary of the diagnostic characters of the two affections will serve to aid him in his investigations.

## CONCUSSION.

1. The symptoms are immediate, coming on instantly after the infliction of the injury.

2. The patient is able to answer questions, although with difficulty, and usually only in monosyllables, as yes or no.

3. Special sensation is still going on, the patient being able to hear, see, smell, taste, and feel.

4. The respiration is feeble, imperfect, and noiseless.

5. The pulse is weak, tremulous, intermittent, and preternaturally frequent.

6. There is nausea, and sometimes vomiting.

7. The bowels are relaxed, and there are sometimes involuntary evacuations.

8. The power of deglutition is impaired but not abolished.

9. The bladder retains the power of expelling its contents; but sometimes, owing to the weakness of its sphincter, the water flows off involuntarily.

10. The voluntary muscles, although much weakened, are still able to contract, there being no paralysis.

11. The pupils are usually contracted, and somewhat sensible to light; the lids are open and movable.

12. In concussion, the mind is in a state of abeyance; it is weak and confused, not abolished.

## COMPRESSION.

1. An interval of a few minutes, or even of a quarter of an hour, sometimes elapses, especially if the compression be caused by extravasation of blood.

2. The power of speech is totally abolished; we may halloo in the patient's ear as loudly as possible, and yet there will be no response.

3. Special sensation is destroyed.

4. The respiration is slow, labored, and stertorous, being performed with a peculiar blowing sound.

5. The pulse is labored, soft, irregular, and unnaturally slow, often beating not more than fifty, fifty-five, or sixty strokes in a minute.

6. The stomach is quiet, and insensible to ordinary impressions, even to emetics.

7. The bowels are torpid, and with difficulty excited by the action of purgatives.

8. Deglutition is impossible, and sometimes does not return for several days.

9. The bladder is paralyzed, and, therefore, incapable of relieving itself, the surgeon being obliged to use the catheter.

10. There is always paralysis on one side of the body, generally opposite to that where the compressing cause is.

11. The pupils are widely dilated, and unaffected by light, the lids being closed and immovable.

12. In compression, the mind is absent, and the patient is comatose.

The *treatment* of compression of the brain must be regulated by the nature of the exciting cause, which it will, therefore, be necessary next to consider.

## a. COMPRESSION FROM EXTRAVASATION OF BLOOD.

This species of compression is of frequent occurrence, and may exist either with or without fracture of the skull. It is invariably the result of external violence, acting, directly or indirectly, upon the vessels of the brain and its envelops. The extravasated blood may be situated at five different points: first, between the dura mater and skull; secondly, in the arachnoid sac, on the surface of the brain; thirdly, beneath the arachnoid membrane, in the furrows of the hemispheres; fourthly, in the substance of the brain; and fifthly, in the lateral ventricles. The first of these sites is the most frequent, and, practically speaking, the most important, as it is the only one admitting of surgical interference. The quantity of blood poured out here is sometimes very great, especially when it depends upon rupture of the middle meningeal artery. I have seen, I am sure, as many as eight

ounces extravasated from this cause; in general, however, the quantity is much less, not exceeding, perhaps, one-half that amount. When the effusion is considerable, the blood usually presents itself as an irregular, dark colored mass, lying in a sac formed by the dura mater and the inner surface of the cranium, the ruptured vessel, it may be, opening directly into it. Large quantities of blood are sometimes observed at the base of the skull and upon the antero-lateral aspect of the cerebral hemispheres, forming broad cake-like clots, from three to six lines in thickness. Copious effusions may also occur in the ventricles; but in the substance and on the surface of the brain they are commonly quite small, though, from the pressure which they exert upon the nervous pulp, they are hardly less dangerous to the cerebral functions.

Having already spoken, in general terms, of the symptoms of compression, it only remains, in connection with this subject, that I should make some remarks on the *diagnosis* between this form of compression and that produced by the depression of bone, and on the distinction between it and apoplexy.

In compression from extravasated blood, the symptoms, although sometimes immediate, do not generally appear under some little time, the interval being occupied by a state of concussion, during which the lacerated vessels, in consequence of the exhausted condition of the heart, pour out hardly any blood; but as soon as reaction begins, the bleeding recommences, and now proceeds with great vigor, the fluid running into, and filling up, every accessible space. It is now, perhaps, before the patient has recovered any consciousness, that compression, for the first time, shows itself, as is evinced by the comatose state of the brain, the stertorous breathing, the slow and laboring pulse, the hemiplegia, or general paralysis, and the dilated and insensible pupil. Occasionally the extravasation results from apparently very trifling causes. A man, for example, receives, what he conceives to be, a slight blow upon the head. He is somewhat stunned; but soon recovering his consciousness, he gets up, and resumes his work. In a short time, often not exceeding ten, fifteen, or twenty minutes, he is observed to turn deadly pale, to reel, and to fall to the ground in a fit, foaming at the mouth, and appearing as if partially asphyxiated. Such an accident is particularly apt to happen when a large artery has been wounded, as, for example, the middle meningeal; the orifice of the vessel having been partially closed during the exhausted state of the system consequent upon the injury, now that reaction has ensued, has become re-opened, and lets out its contents in a full and rapid stream, suddenly overwhelming the brain and heart, and reducing the sufferer literally to the condition of a mere automaton.

In compression from *depression of bone*, the symptoms are immediate. The only exception to this rule is in slight depression, incapable, of itself, of producing compression, but where this occurrence ensues in consequence of injury done to the soft parts, eventuating in effusion of blood, the two causes thus co-operating in bringing about the result. Moreover, extravasation may take place without fracture, or with fracture unattended with depression.



Compression of the brain from extravasation of blood may be mistaken for *apoplexy*. Such an error may readily occur, simply from a want of proper knowledge of the history of the case. Thus, a man may be found in a state of insensibility in the street, with all the ordinary symptoms of compression; no one knows anything of the nature of his affection, and the most thorough examination of the body fails to throw any light upon it. There may not be even a scratch upon the scalp. The man dies, and inspection reveals the existence of a fracture with a large extravasation of blood. The symptoms of the two affections are, in fact, forcibly alike, and the error is really, practically, of no consequence, unless, in the case of compression from external violence, the effusion should happen to be accessible to the trephine.

The *treatment* of this affection will depend upon the site of the effused blood, and the absence or presence of fracture of the skull. When the blood is accessible, it is obvious enough that it should be evacuated; but how is the practitioner to know this? How can he determine whether it is situated immediately beneath the cranial bones, upon the hemispheres of the brain, at the base of the skull, in the cerebral substance, or within the ventricles? Are there any symptoms, any grand landmarks, which will serve to point out the spot where the compressing agent is lodged? The most subtle pathologist and diagnostician must be at fault here. Especially must this be true when there is no fracture, or outward evidence of injury. Indeed, even when there is a fracture, we cannot always be certain. To illustrate: A person has compression, and the symptoms render it pretty clear that it has been caused by extravasation of blood; there is no visible fracture, but a contusion on the scalp denotes where the injury has been inflicted, and hemiplegia exists on the opposite side. Taking these facts in connection, the presumption is that the effusion is on the side of the brain where the head has been hurt, and, acting upon this view, the surgeon, especially if he is fond of operating, may feel inclined to perforate the bone. But is he right in doing so? He may, if he embark upon the enterprise, find the object of his search; but he is groping in the dark, and there is quite as much likelihood that he will fail. The blood may be far beyond his reach, and thus the patient may have been subjected to a fruitless and dangerous operation. Besides, it must not be forgotten that the blood may be at a point opposite to that upon which the blow has been inflicted. A surgeon makes occasionally a fortunate hit. Dr. Physick, in a case of this kind, boldly perforated the skull at the site of injury, and extracting the clotted blood, cured his patient. But how often has the operation failed? Where one surgeon has succeeded, twenty have been disappointed. A judicious practitioner should have something more than conjecture to guide him in such an undertaking.

The truth is the only case in which such a procedure is really warrantable is where the extravasation is associated with, or dependent upon, fracture of the skull, complicated with depression, or serious injury of the soft parts, or where the fracture is situated directly over the course of the middle meningeal artery. But even here the ope-

ration does not always succeed, as I know from personal observation. A boy, ten years old, was thrown off a heavy log, which, rolling over him, broke his skull directly over the right temple. The fracture, although not compound, was comminuted, and, as the symptoms were urgent, I made an incision through the scalp, raised a loose and slightly depressed piece of bone, and extracted a large coagulum. No relief followed; for, as fast as I removed the blood, the osteo-matral cavity, which was quite capacious, filled up again, and I was finally compelled to close the wound, as best I could, with a compress and a tight roller. If this had not been done, the boy, I am sure, would speedily have bled to death. As it was, he died, unrelieved, in less than forty-eight hours.

Cases are occasionally met with where, after the skull has been perforated, the blood is observed to be seated in the arachnoid sac, inside of the dura mater, lifting up this membrane in the form of a small, bluish swelling, beating synchronously with the left ventricle of the heart. Under such circumstances, the proper operation, it has been alleged, is to make an opening into the tumor, and let out its contents. But such a procedure must, it is obvious, seriously complicate the case, exposing the patient to the occurrence of inflammation and fungous protrusion, to leave out of the question the possibility, even in a respectable number of cases, of removing the clotted blood, or, after this has been effected, of preventing a new hemorrhage, perhaps, quite as copious as the original one. My opinion is that little advantage is to be gained from such an undertaking, and that it would be well, in view of its hazards, to refrain from it altogether.

Since, then, so little is to be accomplished by operation, how is the treatment of this affection to be conducted? Obviously, upon the same general principles as that of ordinary apoplexy, from which, as we have already seen, compression from traumatic extravasation differs only in the absence of external injury, as lesion of the scalp and fracture of the cranial bones. The object is twofold: first, to enable the brain to accommodate itself to the effused blood; and secondly, to promote the speedy absorption of this fluid. The first indication is fulfilled, after reaction has taken place, by copious general and local depletion, by the frequent use of active and rather drastic purgatives, and by the administration of the saline and antimonial mixture, along with the use of light diet, cold applications to the head, and perfect quietude both of mind and body. By these means, properly employed, the quantity of the blood is materially reduced both in the brain and general system, and, while the danger of inflammation is lessened, the organ is gradually brought to bear with the extraneous substance, no longer resenting its presence. Blood must not, however, be taken heedlessly or sakelessly. No surgeon, in his senses, would think of bleeding a patient before reaction has been established. But it is unnecessary to repeat here what has already been set forth, in regard to this subject, in speaking of concussion of the brain. The same rules must govern us here, in the use of the lancet, as in exhaustion of the system from other causes. Premature bleeding in this form of compression and in apoplexy, has slain its thousands of subjects, or

compelled the poor and crippled patient to drag out a miserable state of existence.

Mercury should be freely used at an early stage of the disease, as soon, indeed, as possible after thorough evacuation by the lancet and purgatives. It should be given in the form of calomel, in doses of three grains every six or eight hours, its action being assisted by inunction of the groins and inside of the thighs and arms with blue ointment. The gums must not merely be touched, but they must be maintained in a tender condition for a number of weeks. When the case has become chronic, the iodide of potassium takes the place of the mercurial, as there is now less need of hurry.

Throughout the treatment, the greatest vigilance is exercised over the suffering organ, lest, in resenting the encroachment of the coagulum, it should take on inflammation, the slightest approach to which must be instantly met by the resumption of antiphlogistic measures.

Infants occasionally suffer from compression of the brain, in consequence of an effusion of blood beneath the dura mater, before the completion of the ossific process, caused by blows upon the head. The little patient lies in a state of insensibility, and is usually affected with convulsions or spasmodic twitches, and, perhaps, some degree of stertor. Considerable contusion of the scalp generally exists, but there is no fracture of the skull, because the bones are too yielding for such an occurrence, and the fontanel appears to be elevated somewhat above its proper level. Pressure made with the finger discovers unusual tension, and may aggravate the symptoms, especially the disposition to convulsions. Such a case is to be treated on general principles; with leeches and cold applications to the head, and stimulating injections, followed by a brisk purgative as soon as the power of deglutition returns; but if it be very menacing, the duty of the surgeon plainly is to make a crucial incision through the scalp, and dissecting up the angles of the flap, to puncture the distended, and, perhaps, purple-looking membrane with the bistoury, taking care to make the aperture as small as may be consistent with the state of the extravasated blood, and to protect the parts, immediately after the evacuation has been effected, with adhesive strips, a compress, and a roller.

#### b. COMPRESSION FROM THE DEPRESSION OF BONE.

Depression of bone may exist to a considerable extent without compression; but when it gives rise to this state, the symptoms come on immediately, and continue until the brain has either accommodated itself to its new relations, until the offending portion of bone has been removed, or until the patient dies from the effects of the injury. The lesion may be one purely of compression from the depression of bone, or the accident may, as was previously intimated, be combined with extravasation of blood, caused by the laceration of the cerebral or meningeal vessels, either by the depressed bone or by the vulnerating body. In the latter case, the compression may be very violent, although the depression itself may be slight. The symptoms, in this case, too, may, in the first instance, be imperfectly marked, those of concussion perhaps



predominating over those of compression, but speedily succeeded by the latter.

In the *treatment* of this form of compression, which will again come up for discussion in the remarks on fractures of the skull, no very definite rules can be laid down for the guidance of the surgeon. Every case must, so to speak, make its own rules. Practitioners are generally agreed that, when the compression is produced by depression of bone, attended with compound fracture, immediate recourse should be had to trephining, and such a procedure is certainly, it seems to me, the only one that ought to be thought of under the circumstances. In this way we not only remove the cause of compression, but we place the parts in a much more favorable condition for speedy reparation. The question is still an open one as it respects the treatment of compression from depression, attended with simple fracture. I am fully sensible of the difficulties that invest this subject, surrounded as it is by doubt and contradiction; but, after the best consideration that I can bestow upon it, I am disposed to regard operative interference as justifiable only in the event of extensive depression, and I should adopt this plan whether the symptoms of compression were urgent or not, on the ground that the patient would be much less likely to suffer from subsequent cerebral disorder. When the depression is comparatively slight, and especially when there is no comminution of the bone, or great irregularity of its edges, giving them a rough, spiculated character, it would be well to let the bone alone, and to treat the case upon general principles, hoping thereby to prevent inflammatory mischief, and ultimate nervous irritation, which are so much to be dreaded in the more severe forms of the accident. There is a species of compression of the brain in children caused by extensive depression of bone without fracture, of which I have witnessed several remarkable examples, and which never require operative interference. The bone is simply bent or indented, and usually, by its own resiliency, regains its natural level in a few days under the use of a little purgative medicine, light diet, and cold applications to the head.

#### C. COMPRESSION FROM THE PRESENCE OF FOREIGN BODIES.

Compression of the brain by a foreign body is an unusual occurrence, and could hardly take place without some concomitant depression of the skull. A large ball, a piece of iron, or a splinter of wood lodging in the cranial cavity, in the cerebral substance, or in the ventricles, might produce the effect, accompanied, probably, by a pretty copious hemorrhage, thereby seriously complicating the lesion. The symptoms would be likely to be immediate, as in compression from depression of bone, and the treatment would manifestly resolve itself simply into the extraction of the extraneous body, care being taken, in doing this, to inflict as little injury as possible upon the surrounding structures, and to guard the brain and its membranes afterwards against inflammation. Such lesions must necessarily be

fraught with danger, and will rarely be recovered from, however judiciously managed.

*d.* COMPRESSION FROM EFFUSION OF PUS.

Compression of the brain from effusion of pus can occur only as a secondary effect, coming on at a period varying, on an average, from a week to a fortnight from the commencement of the inflammation which precedes its development. Every practitioner, however, meets with cases where the interval is much longer, and to which we may, therefore, apply the term chronic. In general, the characteristic symptoms set in gradually, the disease bearing a great resemblance, in this respect, to the compression of the brain which follows arachnitis. There can, therefore, be no difficulty in discriminating between it and the other forms of compression already described, where the symptoms appear either immediately, or, at farthest, within a few minutes after the occurrence of the injury giving rise to the compression. At first there is evidence merely of inflammation; by and by, as the disease advances, effusion takes place, and now the chain of morbid action is completed by the supervention of coma, paralysis, convulsions, and death. This steady, progressive movement, from one point to another, can leave no reasonable doubt respecting the true nature of the lesion, especially if it be coupled with a consideration of the history of the case.

The pus may be situated at the same localities as the extravasated blood; but, in general, it will be observed to be either between the dura mater and the inner surface of the skull, or in the anterior and middle lobes of the hemispheres. It is frequently formed, it is true, in the arachnoid sac at the antero-lateral parts of the brain, but rarely, in sufficient quantity to produce, of itself, any active compression. When it exists here, it is usually associated with serous effusion, which, being most abundant, becomes in reality the immediate cause of the cerebral trouble. Matter also is seldom found, at least not to any considerable extent, in the lateral ventricles, whereas an effusion of serum is quite common there. In the majority of instances it will be found, when the compression depends upon the presence of pus, that the fluid is situated in the anterior and middle lobes of the brain, which, if I may be permitted to judge from my own experience, have a greater aptitude for this kind of action than any other portion of the organ. When matter forms in the substance of the brain, it is usually collected into an abscess, which, especially in chronic cases, is sometimes inclosed by a distinct cyst, thick, pulpy, and vascular, and containing a greenish, yellowish, or dark-colored pus, the cerebral tissues around being softened and disorganized.

In regard to the precise situation which the matter occupies, the same difficulty exists, in forming an opinion, as in compression from extravasation of blood. It is only, as a general rule, when the matter lies immediately beneath the skull, and when the scalp or bone has sustained considerable injury, that even an approach can be made to anything like a correct diagnosis. When the pus is deeply buried in

the substance of the brain, or lodged in the ventricles, we know of no means by which we can determine its presence. We may, it is true, usually form a tolerably correct idea as to the side on which the effusion exists, by the hemiplegic condition of the body, the right side, for example, being paralyzed when the matter is seated on the left side, and conversely; but to say whether it is situated in the substance of the brain or in its cavities, is an impossibility. In general, it may be assumed that the matter lies immediately beneath the skull when the compression arises from inflammation caused by a bruise or wound of the scalp; when, on the other hand, it follows concussion or fracture of the skull, it will be more likely to occupy the interior of the brain. To this statement, however, there are many exceptions.

The effusion of matter which induces this species of compression may be the result of concussion, sometimes so slight as hardly to attract any attention; of fracture of the skull, with or without extravasation of blood, and with or without depression of bone; and, finally, of injury of the scalp, in the form, perhaps, merely of a slight contusion, or wound, yet sufficient to jar the skull, and detach the pericranium and the dura mater. It is amazing how an apparently trifling accident may sometimes give rise to the most serious consequences, destined to sweep everything before them. A man receives concussion of the brain; his suffering is altogether momentary, and he soon goes about his business; by and by, he begins to feel unwell, his head aches, he has no appetite, his bowels do not act properly, and he sleeps badly at night. Soon symptoms of inflammation of the brain set in, and thus the case progresses, from bad to worse, until effusion of pus takes place, followed by compression. Or, he has met with a fracture, perhaps quite insignificant; he gives himself no trouble about it, and may even entirely disregard the injunctions of his medical adviser. By and by, cerebral symptoms come on; the disease advances insidiously; treatment fails to relieve; matter forms; and the patient perishes from compression. Or, a little bruise has been inflicted upon the scalp, hardly perceptible to the eye, but still sufficient to injure the pericranium; in a few days erysipelas appears; gradually a small puffy tumor forms; rigors, delirium, coma, and paralysis supervene, and the patient finally dies from a collection of pus between the skull and the dura mater, or beneath the dura mater, the inflammation having extended across the bone along the vessels and cellulo-fibrous connections. Or, lastly, the mischief may have been produced by a small wound of the scalp, the blow by which it was inflicted, having, perhaps, detached both the pericranium and the dura mater. Again the case advances insidiously; the ill-boding rigor, delirium, stupor, and paralysis soon appear, and but too clearly indicate the formation of pus.

The *treatment* of abscess of the brain is necessarily most unsatisfactory. When there is reason to believe from the state of the scalp, and the appearance of the skull at the site of injury, that the matter lies immediately beneath the bone, or within the arachnoid sac on the surface of the brain, the removal of a disk of bone by the trephine will, of course, be indicated, but even supposing that the operation is well performed, and the fluid evacuated, the chances are that the



patient will ultimately perish from the mischief sustained by the brain and its envelops during the inflammatory crisis. If, as occasionally happens, a case recovers, it must certainly be regarded merely in the light of a rare exception, and nothing more.

When the abscess is deep seated, whether in the substance of the brain, or in the lateral ventricles, and there are satisfactory evidences of its existence, as indicated by a sense of fluctuation, or by the continuance of deep coma after the removal, perhaps, of a large portion of depressed bone, the surgeon should not hesitate to make a free incision through the superimposed cerebral tissues, in order to afford free vent to the pent-up fluid. Desperate as such a procedure must necessarily be, it is clear that it holds out the only possible hope of relief. In a remarkable case of this kind, Dr. Detmold, of New York, succeeded, by means of repeated incisions, some of them fully an inch and a half in depth, in preserving the life of his patient for seven weeks. An enormous quantity of pus followed the first operation, the patient immediately recovering his consciousness and power of speech.

#### FRACTURES OF THE SKULL.

Fracture of the skull is a frequent occurrence, and is liable, even in comparatively slight cases, to be followed by the worst consequences. It may happen at any portion of the bony case, and may exhibit itself in a great variety of forms, from the merest fissure in the osseous surface to the most extensive loss of substance. In its character, the accident may be simple, compound, comminuted, depressed, or complicated. The import of these terms will be fully understood from what has been said respecting them in the chapter on fractures in general.

All fractures of the skull are the result of external violence, applied either directly to the part, or through the medium of the spinal column. It is remarkable how slight a blow will sometimes produce this injury. Several circumstances may be supposed to contribute to this result, of which the principal are the unusual thinness and brittleness of the cranial bones. It is by no means uncommon to see skulls which are so exceedingly thin as to be quite translucent, not at one point merely, but nearly through their entire extent. My collection contains several specimens, the walls of which are hardly half a line in thickness at the thickest part; they are, in fact, mere shells, composed of compact tissue, with hardly any trace of diploë. Such skulls are also, for the reason just stated, generally very brittle, although this property is by no means peculiar to them, but is often witnessed in comparatively thick crania. When unusual thinness and fragility co-exist in a bone, it requires very little force to break it, either at the point struck, or at some opposite one. The fracture will, moreover, be likely to be uncommonly extensive, comminuted, and depressed. On the other hand, the skull may be so thick and hard as to be almost proof against any force, however severe. In one of my specimens, the average thickness of the cranium is at least half an inch, its density is nearly equal to that of ivory, and hardly a trace is to be seen of a suture. To

break such a skull, even in a comparatively slight degree, would require an amount of violence which is rarely inflicted under any circumstances.

A very frightful fracture is sometimes produced by indirect violence. It occurs when a person, in falling from a considerable height, alights upon the top of the head, and thus receives the whole weight of the body upon the base of the skull. The atlas, being powerfully pressed against the occipital bone, not only breaks it in pieces, but often also the sphenoid, temporal, and frontal bones, as well.

The older writers have much to say about fracture of the skull by *contre-coup*; and in reading their works one cannot fail to be impressed with the conviction that they considered it as an accident of frequent occurrence. Modern research, however, has pointed out the fallacy of this conclusion, by showing that this kind of fracture ranks among the rarest lesions of this portion of the skeleton. The most common site of fracture of the cranium by *contre-coup* is the base of the skull, from blows upon the vertex. Here the force, instead of being expended upon the part struck, is diffused over the cranium, being finally concentrated upon the sphenoid, temporal, and occipital bones, which are either separated along the line of suture, or broken in their continuity. A similar effect is sometimes witnessed in the occipital bone from blows upon the frontal bone, and in the parietal bone of one side from force applied to that of the other side.

The subject of fracture of the skull is an exceedingly complex one, and cannot possibly be understood by the young practitioner without the most careful and attentive study. The following arrangement will, it is believed, facilitate his inquiries and lighten his labors: 1. Simple fracture of the skull, without depression: 2. Simple fracture, with depression: 3. Simple fracture, with displacement, and compression of the brain: 4. Compound fracture: 5. Fracture of the base of the skull: 6. Punctured fracture: 7. Fracture of the external table alone: and, 8. Fracture of the internal table alone. Finally, there may be depression of the skull, sometimes, indeed, of a very marked character, without fracture, the cranial bones being bent rather than broken.

### 1. SIMPLE FRACTURE WITHOUT DEPRESSION.

The term simple, as applied to fracture of the skull, implies that the bone alone is involved, or that, if there be any injury of the soft parts, it does not present itself in the form of an open wound. Some contusion of the scalp must, of necessity, always exist, however trifling or insignificant the osseous lesion. Such an occurrence constitutes a complication, but it is very different from a wound communicating with the seat of the fracture, and which, when present, renders the fracture compound. The most simple form in which fracture of the skull occurs is that of a crack or fissure, similar to what is observed in a broken pot. It is a mere solution of continuity of the osseous tissue, comparable, in many respects, to a simple incised wound. It is unattended with depression or the separation of any pieces of bone. The fissure may involve the

substance of the bone, or it may run along the course of the sutures, its extent varying from a few lines to several inches. It may be caused by direct violence, or, as occasionally happens, by contre-coup.

Such a fracture, provided there is no serious lesion of the soft parts, or of the brain, requires none but the most simple treatment. Rest for a short time in bed, the use of an occasional purgative, rigid abstinence, and the avoidance of mental excitement, constitute the principal means of cure. The brain, of course, is carefully watched; for the shock produced by the accident, causing more or less functional disturbance, may be followed by serious inflammation, and that, too, when, perhaps, it is least apprehended. Operative interference is not thought of; there being no depression of bone and no extravasated blood to remove. The fissure gradually closes up by bony matter, without encroachment upon the inner table of the skull, and, consequently, without injury to its contents. In these cases, the older surgeons used to trephine, sometimes taking away large portions of the skull, and thus seriously complicating an injury which, at the present day, often gets well under the mildest means.

## 2. SIMPLE FRACTURE WITH DEPRESSION OF BONE.

This form of fracture is not at all uncommon; the integuments are more or less contused, and the patient is usually severely stunned by the blow or fall by which he has been hurt. The bone is found to be depressed, or driven beyond the surrounding level, but not sufficiently far to be productive of compression. If the injury has been very violent, the bone may be comminuted, and some of the pieces may be partially detached, pressing, perhaps, against the dura mater. The great danger from such an accident, after reaction has taken place, is inflammation of the cranial contents, and, remotely, nervous irritation, followed by epilepsy. The question then arises, how shall it be treated? Upon this subject, surgeons have been much divided in opinion, some favoring, others condemning, operative interference; favoring, because of the dreaded primary and secondary effects; condemning, because a simple fracture is thus converted into a compound one. Avoiding both these extremes, as calculated, if fully carried out, to be followed by mischievous consequences, the judicious practitioner will be governed, in the choice of his remedies, by the circumstances of each individual case. When the fracture is of small extent, free from comminution, and without much depression, the best plan will be not to attempt elevation, but to treat the patient upon general principles, using depletion by the lancet and other means, with a view to the prevention of inflammation and other evil consequences. If, on the other hand, the bone be forced down considerably, so as to impinge very decidedly upon the brain; or if it be comminuted, or jagged at the edges; the sooner it be raised or removed the better; since, if it be allowed to remain, it cannot fail to become a source of trouble, either by exciting inflammation, or by causing unpleasant secondary effects. I am fully, indeed I may say painfully, sensible of the responsibility which I incur in giving this advice; but I feel satisfied, after mature consider-



ation, aided by the light of experience, that it is the best, if not the only, proper course to be pursued under the circumstances. A man laboring under such an affection is never free from danger; he may get well, or be well to all appearance, and yet be only half cured; for he is subject, at any moment, to have his mind and life imperilled by the broken bone. It is like the sword of the tyrant suspended over the head of his subject.

### 3. SIMPLE FRACTURE WITH DEPRESSION, AND SYMPTOMS OF COMPRESSION.

In this variety of fracture, the bone is not only displaced, but sunk so far below its natural level as to produce compression of the brain. The patient lies in a comatose condition, breathing heavily and stertorously, with dilated pupil, and a slow, laboring pulse, the side opposite to the seat of injury being paralyzed. The symptoms are unmistakable. The fractured and depressed bone, with, perhaps, slight sanguineous effusion, is the cause of trouble. The case, although different from the preceding, has yet much in common with it, the cerebral compression constituting the main feature in the dissimilarity. Here, too, the treatment is not settled, some contending for delay, others for immediate action; the former hoping, by depletion and other means, for cerebral accommodation and prevention of inflammation; the latter trusting, by operative measures, to prevent both present and future evil. Unfortunately, experience, always the best guide in such matters, has not yet fully decided the question as to which of these two plans is to be preferred. Much has been said on both sides; but the tendency decidedly is, if I mistake not, in favor of immediate trephining on the ground that, while the operation adds but little to the risk of the case, the patient has a much better chance of prompt and permanent recovery. As long as the bone is depressed, even supposing that the compression is removed, there is danger of inflammation of the brain and its envelops, to say nothing of the occurrence of epilepsy and other nervous affections, as distressing to the patient as they are embarrassing to the practitioner. My opinion, then, is that operative interference, early and efficient, is, as a general rule, the only proper plan to be pursued under such circumstances. I am sure I should prefer such a course in my own case, if, after all the facts on both sides of the question had been fairly stated to me, I had sufficient judgment left to determine my choice.

### 4. COMPOUND FRACTURE.

A fracture of the skull is said to be compound when the injury of the bone is associated with a wound in the scalp, communicating with the fissure in the bone. Such a fracture may be comminuted or depressed, or both comminuted and depressed, and attended with or without compression of the brain. The scalp is frequently much contused and ecchymosed, and a good deal of swelling generally arises soon after the occurrence of the injury. The symptoms may be those

merely of shock, perhaps severe and protracted, or concussion and compression may co-exist, commencing simultaneously, and running on, step by step, until reaction ensues, or until the case terminates in sinking. Hemorrhage, occasionally quite copious and protracted, may attend the accident, adding to the exhaustion of the already enfeebled frame.

The danger of compound fracture of the skull is threefold: from shock, from inflammation, and from fungus of the brain. When the violence to the bone and soft parts has been unusually severe, death may occur without reaction, or after a feeble and unsuccessful show at restoration; or, the first symptoms having passed off, life may be assailed by inflammation; or, this being happily surmounted, the patient may perish from fungus of the brain. When the fracture is very extensive, and is accompanied with considerable loss of substance and laceration of the dura mater, death may occur from loss of cerebral substance, as in a case which came under my observation in 1852. The patient, a little girl, nearly three years of age, had received a blow from a brick, which literally mashed the top of the cranium, causing extensive laceration of the dura mater, through which the disorganized brain escaped in immense quantity, despite my efforts to prevent it.

The proper *treatment* in compound fracture is to elevate the depressed bone, and to remove any loose or partially detached pieces, this plan being adopted whether there be any compression or not. The case being a compound one, cannot be aggravated by operation, though it is not to be forgotten that this should be executed with the greatest care and gentleness. The operation is done at once, while the parts are still fresh from the first effects of the injury, and, consequently, prior to the supervention of inflammation. Elevation and retention of the depressed fragments are effected whenever this is practicable, but all loose pieces are removed, as well as such as are nearly detached, lest they should become a source of irritation, either present or future, by acting as foreign bodies. In the compound, comminuted fracture, I have, on several occasions, been compelled to take away an extraordinary quantity of bone, fully equal in size to that of the palm of the hand, and yet recovery followed in almost every instance. The danger of such a procedure is probably not as great as is generally imagined, provided there is no lesion of the brain and its envelops. When these structures are wounded, the case assumes at once a grave character, as there is risk then not only of violent inflammation, but also of loss of cerebral substance and of the ultimate formation of fungus; two circumstances which cannot be too much dreaded. I am averse to the retention of any piece of bone, however large, that has lost all connection with the surrounding parts, believing that its reunion, even if it were possible, which, however, it rarely is, would, from the irregularity of the provisional callus, almost inevitably become a source of mischief, leading perhaps, at length, to the necessity of trephining. Whenever such a procedure is required, due support must be given to the now unprotected brain by sheet lead, compress and bandage, otherwise there may be extensive protrusion of the cerebral pulp before the

surgeon is aware of it, the brain rising and tending to escape at every pulsation of the heart. I have found it extremely difficult, in several instances, successfully to counteract this tendency, by any means that I could adopt; the consequence was that the patient soon fell into convulsions, and speedily perished.

The offending bone having been raised, or removed, the edges of the wound are gently approximated by suture and plaster, the whole being supported by a compress and roller. The head, previously well shaved, is maintained in an elevated position, and kept constantly wet with cold water, or, what is better, a bladder partially filled with pounded ice, or some refrigerant lotion. If the patient is young and plethoric, and there has been no serious hemorrhage, blood is taken freely from the arm, and by leeches from the temple, the bowels are thoroughly moved by drastic purgatives, and the heart's action is equalized by the antimonial and saline mixture, aided by the moderate use of opiates. Light and noise are excluded from the patient's apartment, and the diet is of the mildest and simplest character, consisting of a little panado, thin gruel, or arrowroot, along with acidulated drinks.

Great prejudice exists in the minds of practitioners against the employment of anodynes in fracture of the skull, even in its worst forms, on account of their supposed tendency to cause congestion of the brain, thereby increasing the danger of inflammation. I believe that this opinion is not only groundless, but fraught with mischief. In the first place, it is by no means established that opiates, judiciously administered, produce cerebral congestion; and secondly, even supposing that they did, the occurrence would be no contra-indication to their exhibition. If they produce congestion at all, the congestion is of a passive, and not of an active character, and, therefore, comparatively harmless. But I do not look upon the matter in this light; on the contrary, I believe that anodynes, by controlling the heart's action, exert a direct and positive influence in controlling inflammation of the brain, by placing the organ in a state of repose, so essential in every case of disease and injury, no matter how induced, or where occurring. The brain, in the normal state, rises and descends with every movement of the left ventricle of the heart; in injury, this action is greatly increased, becoming often quite tumultuous and overwhelming; the nervous pulp receives a shock at each pulsation; it is never at rest, and has, therefore, no opportunity to repair the mischief that has been inflicted upon it. Now the object of the anodyne is to insure this result by paralyzing the heart, and thus rendering it unable to send to the brain the accustomed quantity of blood. If this mode of reasoning be correct, it follows that the wounded organ, receiving less blood than usual, will be less prone to inflammation. We can secure repose for it in no other way. We may carry the inflamed hand in a sling, and apply splints to the inflamed leg, but we can insure tranquillity to the brain, heart, lungs, stomach, bowels, and peritoneum only by the use of anodynes. But these remedies do good in another capacity under these circumstances. They induce sleep, allay pain, and quiet the mind, effects which cannot fail to promote recovery, when, from the frightful nature of the injury, recovery is not impossible.



*Gunshot fractures* of the skull are always necessarily of a compound character, and are apt to be followed by the worst consequences, from the bone being splintered and driven into the substance of the brain, as well as from the lodgment of the ball. Nevertheless, an extraordinary exception occasionally occurs, the patient making an excellent recovery, as it were, despite the injury. This was well exemplified in the case of a youth, aged eighteen, the particulars of which have been kindly communicated to me by Professor May, of Washington City. The ball, an ounce one, entered the upper and back part of the skull, making an opening capable of receiving the index finger, and penetrating the brain, as was proved by the fact that some of it had escaped at the wound. Where the ball lodged could not be ascertained. Rapid and complete recovery followed without a solitary untoward symptom.

The treatment of gunshot wounds of the skull must be managed upon general principles. Loose splinters are, of course, at once removed, but all officious searching for the ball must be avoided.

Fractures of the skull inflicted by the *sword*, *sabre*, or *Indian arrow*, are also generally of a very grave character, usually proving fatal, either from shock, hemorrhage, or inflammation. A sharp arrow, as Dr. T. C. Henry, of the U. S. Army, informs me, will cut a hole into the skull, owing to the great force and velocity with which it is propelled, without apparently any fracture whatever, producing a kind of incised wound, which, however, is very liable to be followed by death. A portion of the outer table of the skull is sometimes sliced off by the *sabre* or *sword*, hanging, perhaps, merely by a narrow flap of scalp. When this is the case, the parts should immediately be replaced, and secured by suture, in the hope of their speedy reunion.

##### 5. FRACTURE OF THE BASE OF THE SKULL.

Fracture at the base of the skull may be perfectly simple; mild symptoms characterizing the affection, and mild remedies sufficing for its relief. But it is far otherwise when the fissure is extensive, owing to the lesion sustained by the brain and its envelops, the former being often severely concussed, and the latter freely detached, large quantities of blood being at the same time frequently extravasated at the site of injury, either in the arachnoid sac or beneath the *dura mater*. The accident is usually caused by falls upon the vertex, or by the head being crushed laterally, as by the passage of the wheel of a carriage, or by the head being jammed in between two hard and resisting bodies, as a post and a railroad car. A fall upon the buttocks, knees, or feet may also produce this fracture, but such an occurrence must be extremely rare, and will be likely to happen only when the cranial bones are uncommonly thin or brittle. In most of the cases of this fracture that have come under my observation, the injury was occasioned by the person pitching head foremost from a second story window or a high scaffolding down upon the pavement, the weight of the body being received upon the vertex. In a remarkable instance of this kind, which was treated in 1846 by Professor T. G. Richardson, in the Louisville Hospital, and which I had an opportunity of seeing

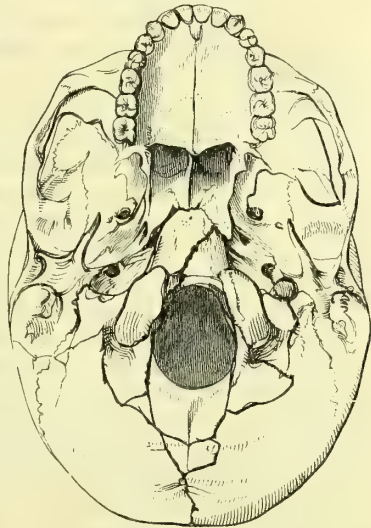
soon after the occurrence of the accident, the fracture extended in a circle around the occipital, sphenoid, temporal, and frontal bones, separating them completely from the rest of the skull. The man had been pushed down a high flight of stairs, and in the fall had struck his head violently against the floor. He was picked up immediately in a state of insensibility, in which he continued, without any successful attempt at reaction, until he died, about forty-eight hours afterwards. Dissection showed not only the frightful extent of fracture above described, but an immense coagulum at the base of the skull.

The adjoining cut (fig. 146) affords an excellent illustration of the form of fracture now described. It will be observed that the occipital, temporal, and sphenoid bones are most extensively fissured, the injury having been occasioned by a fall upon the vertex.

It is, then, not so much in consequence of the fracture, as of the great mischief inflicted upon the soft parts, the brain in particular, that this injury is so much dreaded by the intelligent surgeon. The moment he sees his patient, he is fully impressed with the critical nature of his condition. The symptoms are always of the worst possible description. They are invariably those of concussion and compression, the latter coming on early, and usually continuing, with little or no mitigation, until the close of life. The countenance is deadly pale, the pulse is feeble and hardly perceptible, the respiration is nearly extinct, the pupils are widely dilated, and there is not the slightest sign of sensibility of any kind. Blood often issues from the ears, the nose, and the mouth, from some of the vessels in these parts having given way, in consequence of the severity of the blow or fall inflicting the injury. Occasionally the bleeding from the ears is quite copious, especially when there is fracture of the petrous portion of the temporal bone, and sometimes even when there is merely a rupture of the tympanum. Now and then the blood proceeds from the interior of the skull, through a crack in the cranium communicating with the nose or mouth.

An escape of serosity from the ears is occasionally observed, and great stress has been laid upon it by recent writers on account of its supposed diagnostic value. The discharge generally appears within a short time after the accident, and after having continued, often quite profusely, for several days, gradually vanishes. As many as three, four, and even five ounces are lost in the twenty-four hours, the fluid dropping upon, and saturating the patient's pillow. It is strongly saline in its taste, of a clear watery aspect and consistence, and en-

Fig. 146.



Fissure at the base of the skull.

tirely destitute of coagulability, containing merely a trace of albumen, and differing, therefore, essentially from ordinary serum. The source of this discharge has been variously explained, but the most plausible theory is that it consists of the cephalo-spinal liquid, and that its evacuation through the ear is effected by the rupture of the cul-de-sac of the arachnoid membrane which surrounds the auditory nerve as it passes along the auditory canal in the petrous portion of the temporal bone. This view of the case is certainly very strongly favored by the similarity in the physical and chemical properties of the two fluids, and by the fact that the serous investment of the brain has been found to be torn completely across, opposite the outlet at which the escape has been observed to take place. The discharge is usually most abundant, as well as most common, in young subjects.

The *diagnosis* of fracture at the base of the skull is not, I think, as difficult as is generally supposed. The history of the case, the co-existence of violent concussion and compression, the profound coma and insensibility, the absence of fracture at the more accessible portions of the cranium, and the obstinate persistence of the symptoms, are sufficiently declarative, in most cases, of the nature of the accident. The inferences derived from these sources will be materially strengthened, if there be at the same time a discharge of blood from the ears, profuse, and continued, as it will be likely to be when there is fracture of the petrous portion of the temporal bone. A flow of serosity from these passages is an infrequent, but, diagnostically considered, a most valuable occurrence, as it always affords indubitable evidence of the lesion in question. Bleeding from the nose and mouth may proceed from other causes, and cannot, therefore, be rendered available in the discrimination of the present affection.

Fracture at the base of the skull is one of the most serious of accidents. If it does not always terminate fatally, the number of recoveries is so few as to form merely an exception to a law which is by many regarded as general. I have, myself, out of at least a dozen cases of the kind, witnessed only one restoration. That the injury should usually end in this way is not surprising, when we reflect upon its violent and complicated character, and upon the fact that under any circumstances, hardly anything is to be effected by treatment, which is obliged to be altogether expectant. Operative interference is, of course, wholly out of the question. The only thing to be done, in the first instance, is to endeavor to establish reaction, and, if this should fortunately take place, afterwards to employ means for averting inflammation. In most of the cases that have come under my observation, the patient never recovered from the unconscious and exhausted condition consequent upon the first blow, death having usually occurred before the end of the third day.

#### 6. PUNCTURED FRACTURE.

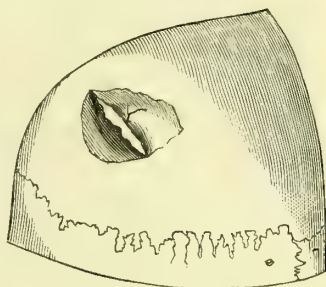
A punctured fracture is a small, circumscribed opening in the skull, attended with depression of both tables, the inner, however, being always more displaced, as well as more badly broken, than the outer.



It derives its name from its size, which is often quite insignificant, and from the circumstance that it is always produced by a narrow weapon, as a poker, bayonet, or dirk. It is sometimes caused by a fall upon a nail, a sharp stone, or the top of an iron rail; and I have seen several cases where it was produced by a blow with a brick, the angle striking the bone. From the manner in which the injury is inflicted, there is always necessarily severe contusion of the scalp, if not laceration of its entire thickness, constituting, in the latter case, a compound fracture.

The annexed drawing (fig. 147), from a preparation in my collection, affords an excellent idea of the nature of this variety of fracture. The case was neglected, or mismanaged, and the man died in three weeks, from abscess of the anterior lobe of the brain, caused by the pressure of the depressed bone.

Fig. 147.



Punctured fracture is not often attended with compression; for, although the inner table of the cranium may be considerably depressed, there are few cases where it causes such an amount of pressure as to produce this effect. Sometimes a sharp spicule of bone dips down into the membranes of the brain, and even into its substance, seriously complicating the case. The accident is always easily recognized by inspection and digital exploration, aided, if necessary, by the probe, the latter often affording important information relative to the nature and extent of the depression. However simple, a punctured fracture of the skull should always be regarded as an occurrence of the most serious character, from which, unless it be properly understood and treated, few persons ever make a happy escape. The great danger is inflammation of the brain and its membranes, frequently coming on within a few days after the accident, and sure to terminate fatally, if the case have been neglected or mismanaged. Should the patient be so fortunate as to escape with his life, he can scarcely fail to suffer afterwards from cerebral irritation, especially epilepsy and mental imbecility. In view of these occurrences, practitioners have long been agreed that the proper treatment is trephining, performed at the earliest possible moment, and without the slightest regard whatever to the character of the head-symptoms; or, in other words, as to whether there be compression or not.

It is sometimes extremely difficult to persuade a patient, when he has merely a little hole in his cranium, without pain, headache, or any other symptom of consequence, to submit to what he regards as so serious an operation as that of boring the skull. I recollect a memorable instance where a man lost his life from this cause. He had been struck, early one morning, with a brick upon the head, resulting in a punctured fracture over the middle of the left parietal bone. He was stunned for a few minutes by the blow, but soon recovering, he cursed the fellow who had played him the shabby trick, and immediately

set out for my office, a distance of nearly two miles, on horseback. Upon his arrival, he was in every respect comfortable, except that he complained of a little soreness of the scalp. Discovering the nature of the fracture, I pointed out to him very fully its dangers, and begged him to submit without delay to an operation for his relief. To this, however, he would not consent, and I accordingly dismissed him, having previously enjoined upon him absolute rest, light diet, and constant elevation of the head, with the use of the cold water-dressing. Two days afterwards I was sent for, having been informed that he was very unwell. I found him quite feverish, with a tendency to delirium. Again an operation was urged, and again declined. He grew gradually worse, and on the seventh day, when he was in a comatose condition, his wife permitted me to use the trephine. No relief followed the operation, and he died in thirty-six hours after. Pus and lymph were found at the seat of the injury, the brain was slightly softened beneath, and the lateral ventricles contained several ounces of serum. Who can doubt that this man lost his life by his obstinacy and folly? Could he have been immediately trephined, there is reason to believe that he would have made a speedy and perfect recovery.

#### 7. FRACTURE OF THE EXTERNAL TABLE ALONE.

This species of fracture is extremely rare, and can occur only in the adult, or in persons whose cranial bones have a distinct diploë. Moreover, its occurrence implies unusual brittleness of the outer table, and inordinate firmness of the inner. The fracture is generally of small extent, and the depression inconsiderable. The most common cause is a blow from a narrow, blunt-pointed body. Besides being momentarily stunned, the patient suffers no particular inconvenience, save what results from the scalp-lesion. The diagnosis of such a fracture must necessarily be obscure, and, unless great care be taken, it might easily be confounded with the punctured fracture just described. Mistake will best be avoided, in case of wound, by a careful use of a fine probe, carried around the edge of the depressed bone, by the pressure of the finger, and by filling the artificial hollow with water. If the probe enter any side crevices, the finger cause motion, or the water disappear, there will be strong reason to conclude that the fracture involves both tables of the bone, and that it is of a punctured nature. The injury requires no particular treatment, apart from that which may be necessary on account of the lesion of the scalp and brain.

A fracture of the outer table of the frontal sinus is sometimes met with. I saw a singular case of this description a few years ago, along with Dr. Ronalds, in a lad, eight years old, from a blow with a piece of brick. The outer table of the left sinus was broken at several points, and knocked considerably below the natural level. A wound, one inch long, existed on the left eyebrow. In attempting to raise the depressed bone, which I succeeded in doing with a delicate and slightly curved awl, the boy had a violent convulsion, but from this he soon recovered, and he had no bad symptoms afterwards.

## 8. FRACTURE OF THE INTERNAL TABLE ALONE.

This fracture is still more rare than the preceding; indeed, it is so uncommon that many surgeons of large experience have denied the possibility of its occurrence. I have, myself, never seen an instance of it; but that it has been met with by others, although very seldom, is indisputable. In the few cases of it upon record, the fracture was caused by the blow of a bullet, or some other concentrated violence, sufficient to break the inner table without cracking the outer. The lesion is seldom discovered until after death, and then, perhaps, only accidentally, as it does not give rise to any marked, much less characteristic, symptoms. When it is suspected to exist, and especially when there is concomitant compression, the proper remedy would be the trephine, for the same reason that that operation is performed in punctured fracture.

## 9. DEPRESSION WITHOUT FRACTURE.

Depression of the cranial bones without fracture can take place only in very young subjects, before the completion of the ossific process. It is a bending rather than a fracture of the osseous fibres, and is confined chiefly, if not entirely, to the frontal, parietal, and occipital bones. It is usually produced by a fall from a considerable height, in which the child alights upon the top of the skull, which is sometimes flattened in a most grotesque manner, and in a most extraordinary degree. I have seen only two instances of this occurrence, one of which, I recollect, made a great impression upon me at the time, on account of its novelty and extent. It took place, during my residence at Cincinnati, in a child two years and a few months old, who, in falling down a long flight of stairs, struck its head violently against the floor. It was picked up in a state of insensibility, and, for a few minutes, it was supposed to be dead. Signs of reanimation, however, soon appeared, and in a few hours the reaction was perfect. The anterior and upper portion of the skull was completely flattened, the frontal and parietal bones being pressed out in such a manner as to give the head a most singularly deformed appearance. The child lay for the better part of a day in a comatose condition, with frequent spasmodic twitches, but no decided convulsions; both pupils were dilated, but not altogether insensible to light, and the pulse, after the subsidence of the shock consequent upon the fall, was slow and labored. Under mild treatment, these symptoms gradually disappeared as the depressed bones regained their natural level, which they did in less than a week from the time of the accident. In the other case, the depression was much less, and the effects proportionably milder. In the *American Journal of the Medical Sciences* for August, 1840, a very extraordinary case of this accident is related by one of my former pupils, Dr. Burt, now of the United States Navy. A child, three years old, fell out of a second story window, head-foremost, upon the pavement below, a distance of sixteen feet, knocking the skull as



flat as a board, the frontal bone projecting two inches over the eyebrows. For an hour the child had symptoms of violent concussion; then slight convulsions came on, followed by vomiting, which afforded great relief. The treatment consisted of cold applications to the head, and of gentle cathartics. No fracture could be detected. The bone speedily began to resume its natural position, and in a short time the skull had regained its former shape.

In cases similar to those now mentioned the *treatment* resolves itself into the adoption of the most gentle measures, as leeches and cold applications to the head, purgatives, and stimulating enemata. If the patient is very plethoric, blood may be taken from the arm, but, in general, this will be unnecessary. The bone will gradually resume its natural position, by its own resilient powers and the pulsatory movements of the brain. All interference with the trephine is, of course, avoided.

If the child be very young, an attempt may be made to raise the bone by suction with a cupping-glass, as was done successfully in one case, in 1849, by Dr. W. L. Moultrie, of Charleston. The depression occupied the parietal bone, and was large enough to contain with ease the bowl of a common tablespoon. The instrument having been properly adjusted, and exhausted of air, traction was made upon it with the effect of rapid and complete restoration of the entire surface to its natural level. The child, which was five months old, recovered without an untoward symptom.

#### 10. APPARENT DEPRESSION.

The practitioner is sometimes sorely puzzled to determine whether, what he sees and feels upon the skull, is really a depression of the bone, or merely a deceptive appearance. Of this occurrence I have seen several well-marked instances, and as it is by no means uncommon, it is very important that we should be acquainted with its true character, lest we should be tempted to use the trephine in cases which will either yield to very slight treatment, or where, from the injury done to the brain, treatment of every description is hopeless. The manner in which it is produced is easily understood. A man receives a blow or fall upon the head, severely contusing the scalp, and perhaps inflicting serious injury upon the cranial contents. Upon examination, a tumor is found, having a depressed centre, and elevated edges, its size perhaps equalling the palm of a small hand. The depression indicating the spot upon which the violence was concentrated, is due solely to the condensation of the tissues of the part; while the tumor itself is caused by the blood that is extravasated at the time of the accident, and which now distends the cells of the adjacent structures.

The first case in which I noticed this occurrence was that of an elderly man, who was brought into the Louisville Hospital in a state of coma from a fall which he had received a short time previously from a second-story window upon the pavement below. The tumor, which was uncommonly large, existed upon the right side of the head, over the parietal protuberance; its edges were remarkably prominent and well

defined, and the central cavity felt precisely as if it had been caused by a fracture with depression of the bone. A careful examination, however, satisfied me that the appearance was altogether deceptive, and the death of the man, occurring nine hours afterwards, confirmed the accuracy of my diagnosis. The parietal bone was perfectly sound, but one of the most extensive fractures that I have ever known, existed at the base of the skull, along with immense effusion of blood.

A boy, aged sixteen, in riding rapidly round a race-course, was pitched, head-foremost, off his horse against the earth, the animal being at the time under full speed. He was picked up in a state of utter insensibility, and a large tumor was discovered just above the left eyebrow, with a well-marked central hollow. Although convinced that the bone beneath was sound, I was induced, at the request of Dr. Knight and Dr. Wakefield, to cut through the part, but found no fracture. The lad never recovered his consciousness, and died in a few days after the receipt of the injury. An extensive fracture existed at the base of the skull.

A mulatto boy, aged eleven years, a patient of Dr. O'Reilly, was thrown off his horse, striking his head violently against a fence. On the right side of the head, just in front of the temple, was a severe contusion, feeling very soft, and readily permitting the finger to sink down into it at the centre, thus imparting the sensation of a badly depressed fracture. The lad had been somewhat stunned, but soon regained his consciousness. Being in doubt whether the appearance was real or not, I made a small incision across the swelling, down to the bone, but there was no fracture. Recovery occurred without an unpleasant symptom.

To the above cases I might add several others, but as they are sufficiently typical of the occurrence in question this will be unnecessary. What increases the embarrassment in such cases is the fact that the deceptive appearance of the scalp is often associated with symptoms of compression of the brain, inducing the idea that the cerebral affection might be caused by depression of the skull.

Doubt may sometimes be thrown upon our diagnosis by malformation of the skull. A man, aged thirty-two, was admitted into the Louisville Hospital in 1849, on account of a wound upon the posterior part of the head, received a week previously by being struck with a piece of iron. He was stunned by the blow, and was hardly able to walk across the room for several days after. The wound, which was about two inches and a half in length, extended down to the bone, and was situated over a ridge just behind the lambdoidal suture. On passing my finger around the wound, I found, immediately in front of it, a broad, deep hollow, reaching forwards towards the sagittal suture, and looking very much like a depression from a fracture. Upon inquiry, however, I ascertained that it had always existed there, having been the result of malformation. The patient, on his entrance, had violent headache, along with considerable fever, for which he was bled and purged, and from the effects of which he soon recovered. Had he labored under compression of the brain, the deceptive appearance

caused by this state of the bone might have induced an incautious surgeon to apply the trephine.

It is hardly probable that any surgeon, at the present day, would mistake a suture of the skull for a fracture. Such an error is said to have been committed by Hippocrates, who actually applied the trephine for the relief of his patient. An accident like this could only be excused in a case where symptoms of compression are superadded to a depressed appearance of a bone from malformation, the suture running across its surface, and the scalp being more or less contused from the injury.

#### RECOVERY AFTER BAD INJURIES.

Very astonishing recoveries occasionally take place after injuries of the brain and skull. Thus, in a case which occurred to Dr. Ellerslie Wallace, of this city, and the particulars of which have been narrated in the *North American Medico-Chirurgical Review* for January, 1858, the fracture, inflicted by a circular saw, was four inches and a quarter in length by one-sixth of an inch in width, extending horizontally across the skull, along the coronal suture, wounding the brain, and dividing the longitudinal sinus, and yet the patient, a girl ten years of age, rapidly recovered without one untoward symptom.

A still more extraordinary case happened in 1848, in the practice of Dr. J. W. Harlow, of Vermont; a case so unique that, if it were not well attested, its occurrence could hardly have been supposed possible. The accident took place while the man, who was twenty-eight years of age, was engaged in blasting rock, and was caused by the propulsion of a tamping iron, three feet seven inches in length by one inch and a quarter in diameter, its weight being upwards of thirteen pounds. The iron entered by its narrow extremity, near the angle of the lower jaw, on the left side, passing obliquely upwards behind and below the zygomatic arch, traversing the skull, the anterior lobe of the cerebrum, and the longitudinal sinus, and fracturing, as was supposed, the malar, sphenoid, temporal, and frontal bones, at the latter of which it emerged, just in front of the coronal suture. Notwithstanding this horrible mutilation, enough, one might imagine, to kill a dozen ordinary men, the patient made an excellent recovery, completely regaining his mental and physical faculties, except the loss of the left eye. An elaborate report of this interesting case, illustrated by drawings, has been published by Professor H. J. Bigelow, in the *American Journal of the Medical Sciences* for July, 1850.

#### OPERATION OF TREPHINING.

The circumstances which require this operation are: 1. Compound fracture with depression of the bone, with or without symptoms of compression. 2. Simple fracture with depression and symptoms of compression after a fair trial of ordinary means. 3. Punctured fracture, no matter what may be the condition of the brain. 4. Extravasation of blood between the skull and dura mater, or in the arachnoid sac



on the cerebral hemispheres. 5. The existence of pus in the same situations. 6. Epilepsy, and other secondary effects.

In performing the operation, the patient is placed upon a narrow dining-table, or lounge, the head and shoulders being properly elevated by pillows, covered with a sheet and a piece of oil-cloth. If he is faint, the less the head is raised the better. The scalp being extensively shaved, the bone is exposed by a suitable incision, of which the semilunar, T-shaped, V-like, or crucial, are the most common. Sometimes the bone is sufficiently denuded by the accident, or so nearly so, as to render but little dissection necessary. In no event should any portion of the scalp, however severely it may be lacerated or contused, be cut away. The bleeding which follows the use of the knife usually ceases in a few minutes of its own accord; but should it not do so, it is easily arrested by the ligature; which, however, should always, if possible, be avoided, as it has a tendency to interfere with the adhesive process. The periosteum, upon the integrity of which the welfare of the bone so essentially depends, is cautiously dealt with, the flaps being, if practicable, drawn towards the sides of the wound, and carefully held there until the operation is completed. I am sure that if more attention were paid to this subject than there is, there would be much less danger of exfoliation of the bone; an occurrence which often greatly retards the cicatrization of the parts, and leads to much pain and inconvenience. All scraping is inadmissible.

The crown of the trephine, which should always be fluted, and of which there should be several sizes, is planted upon a sound portion of the bone, to a degree just sufficient for the accommodation of the centre-pin, which is always protruded at the moment of the application. The instrument is then moved by semi-circular sweeps from left to right and right to left, until it has formed a groove deep enough to maintain its place, when the pin is permanently retracted, lest, upon reaching the inner table, it pierce the cranial contents. The sawdust is removed from time to time from the trephine with the brush, or, what is preferable, a wet sponge, and from the track in the bone with the toothpick. Approach to the diploë, if any be present, is indicated by greater freedom of motion, a more abundant flow of blood, and a less grating sound. The instrument is now turned with more and more caution, and in such a way as to divide the inner table simultaneously at every point. There is no necessity for any hurry; the patient is frequently insensible from the accident, or is rendered so by chloroform, and hence the whole proceeding is conducted in the most deliberate manner, the operator constantly bearing in mind that any injury, however slight, which he may inflict upon the brain and its membranes, may seriously compromise the patient's safety. The disk of bone frequently comes away in the saw; but where this does not occur, it is readily raised with the finger, forceps, or elevator. All depressed pieces of bone are next elevated, and all loose pieces removed. The edges of the osseous orifice are then smoothed with the raspator, blood and other extraneous matter are carefully cleared away, bleeding vessels are tied, and the wound in the scalp is accurately secured by suture and plaster, a small interspace being left for drainage, unless there is

the strongest reason to believe, from the appearance of the parts, that they will unite by the first intention. Over this dressing is applied a tolerably stout compress, confined by a roller, to support the beating brain, and prevent the occurrence of fungus.

The annexed cut (fig. 148) represents the trephine which, from long use, I prefer to any other. It is a very beautiful instrument; and such

Fig. 148.

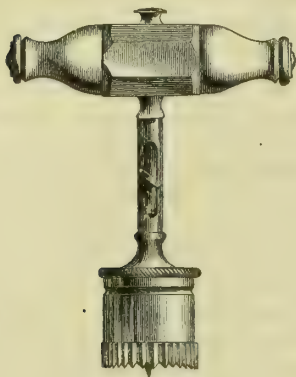
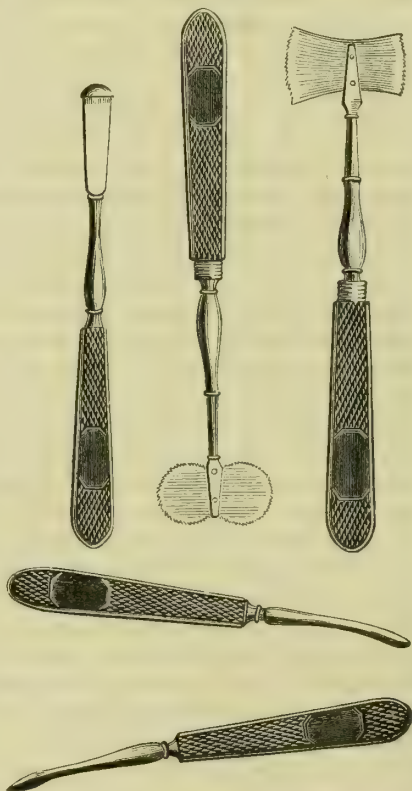


Fig. 149.



is the facility with which it may be worked that, unless the skull is of extraordinary density, the operation may usually be accomplished in a very short time. The other instruments which usually accompany the trephine are represented in fig. 149. They consist of a pair of Hey's saws, or, more properly speaking, the saws of Scultetus; an elevator, a lenticular, and a raspatory.

There are certain points of the skull where, if it be possible to avoid it, the trephine is never applied. These points are the frontal sinus, the anterior inferior angle of the parietal bone, the course of the longitudinal sinus, the occipital protuberance, and the different sutures. The reasons for this injunction are sufficiently obvious. Exposure of the frontal sinus might lead to a fistulous orifice, attended with a constant escape of air and mucus; at the second point indicated is the middle artery of the dura mater, running sometimes in a deep furrow of the bone; at the top of the skull is the longitudinal sinus; and in the occipital region there is not only inordinate thickness of bone, but danger of interfering with the lateral sinus. Should an operation at any of these situations become imperative, the greatest caution should be employed in its execution. When the frontal sinus is obliged to be penetrated, two trephines must be used, a large one for the external table, and a smaller one for the internal.

The operation being over, the patient is placed in bed with his head and shoulders well elevated, and subjected to the most rigid antiphlogistic regimen. The great danger, of course, is inflammation of the brain and its meninges, and hence the head should be most diligently watched, in order that the earliest moment may be seized to counteract the slightest untoward occurrence. The dressings are removed from time to time, as they become soiled, or a source of irritation, and great care is taken that the formation of pus beneath the replaced scalp does not become a cause of cerebral oppression. Should this be found to be the case, the dressings must immediately be removed, and, if necessary, a puncture must be made through the superimposed parts, to afford a proper outlet to the pent-up fluid.

The opening left by the trephine is generally closed by fibrous tissue; sometimes by fibro-cartilage, and occasionally, though very rarely, by a thin stratum of osseous substance. The site of the injury is ever afterwards indicated by a depression in the skull, and for a long time the pulsations of the brain are perceptible across the adventitious structure. As this matter remains weak and thin for years, and, consequently, affords but a very imperfect protection to the brain, the opening should be kept constantly covered with some suitable contrivance, as a piece of leather, silver, or gutta percha. For want of this precaution, fatal accidents have occasionally occurred.

The operation of trephining has been followed by different results in the hands of different surgeons. In general, they are anything but flattering. In the hospitals of Paris the operation is nearly always fatal; in London, Dublin, Edinburgh, Glasgow, and other large cities of Great Britain, the mortality, although also very high, is much less; and in the United States, the number of recoveries in proportion to the number of deaths is, as nearly as we can arrive at the matter, as one to four. From the statistical accounts, by Dr. Lente, of fractures of the skull, occurring in the New York Hospital, it appears that eleven out of forty-five who were subjected to this operation recovered. There is reason to believe that the greatest success of the trephine is to be found in private practice. My own experience has furnished me with a number of excellent recoveries, and some of my friends have been equally fortunate. The mortality of the operation will, of course, be materially influenced by the nature of the case, the character of the existing complication, the habits of the patient, and various other circumstances, which will readily suggest themselves to the mind of the reader. The operation itself is not free from danger, as is proved by the fact that it is often fatal when it is performed for the relief of epilepsy and other severe nervous symptoms.

*Trephining in Epilepsy.*—The operation of trephining is occasionally performed for the relief of epilepsy consequent upon neglected cases of depressed fracture of the skull. The first attempt of this kind was made by La Motte, in 1705, but with only partial success. In 1804, Mr. Cline, of London, recalled attention to it by the publication of a successful case; and since then it has repeatedly been performed for this purpose both in Europe and in this country. Dr. Dudley, of Kentucky, in 1828, published a valuable paper upon the subject in



the first volume of the *Transylvania Journal of Medicine*, in which he detailed the particulars of five cases of epilepsy treated with the trephine, of which three were successful. The results of the practice of other surgeons have not, however, I think, been so flattering. I have myself had occasion to perform the operation four times, with the effect of one cure and three deaths; and I have witnessed its execution in three other cases, all of which terminated fatally. In nearly all of these cases death occurred within the first week from inflammation of the brain and its envelops, evidently induced, not by any direct injury inflicted upon them in the operation, but by the disturbance of the cerebral circulation consequent upon the removal of the depressed bone. In all these cases, the event in question occurred, notwithstanding the most thorough preparation of the system, and the most assiduous attention during the after-treatment. In one of my own cases, that of a man aged thirty-three, whom I trephined at the Clinic of the Jefferson College, in 1857, the cause of death was quite unique. The depression, which had existed ever since he was eight years old, involved the upper portion of the parietal and frontal bones, and was nearly two inches in diameter, by upwards of half an inch in depth at its centre. At the age of twenty two epileptic convulsions set in, and continued to recur, with increased severity and frequency, up to the time of the operation. Latterly his speech, memory, and general health had become so much impaired as to render him unfit for business. A large disk of the depressed bone being removed, the case seemed to progress favorably for forty-eight hours, when, stupor and spasms coming on, he gradually lapsed into a state of unconsciousness, and died five days afterwards.

The dissection revealed the existence of extensive softening of the cerebral hemisphere at the site of the depression and an enormous effusion of black blood, with an opening, large enough to receive the end of the index finger, in the membranes of the brain. This opening, which was noticed at the time of the operation, was produced by the pressure of a small exostosis on the inner surface of the injured bone, and permitted a free escape of the cephalo-spinal fluid, both during and after the operation. The pressure upon the brain being thus removed, the diseased vessels at the seat of the softening gave way, thereby causing fatal apoplexy.

In a paper on the surgical treatment of epilepsy by Dr. Stephen Smith, in the *New York Journal of Medicine*, for March, 1852, an analysis of twenty-seven cases of this disease, subjected to trephining, is given, of which only seven are set down as having been cured, thus furnishing a ratio of about one to four.

Finally, trephining is occasionally required for the removal of necrosed bone, perhaps incarcerated by an overlapping ledge of the cranium. In a case of this kind, under my charge at the Louisville Hospital in 1842, the sequester was not only prevented from escaping, in consequence of the narrow state of the opening in the skull, but the irritation which its pressure exerted upon the brain and its membranes was such as to cause repeated attacks of epilepsy, which promptly and permanently disappeared upon the extrusion of the offending substance.

## WOUNDS OF THE BRAIN AND ITS MEMBRANES.

Wounds of the brain and its membranes may be produced in various ways, or by whatever is capable of causing fracture of the skull. From the character of the weapon by which they are inflicted, they may be incised, punctured, lacerated, contused, or gunshot. They may occur without fracture, as when they are the result of contre-coup, but the most severe varieties of the injury are always associated with fracture and wound or laceration of the meninges of the organ. As stated under the head of concussion, this lesion is not unfrequently complicated with laceration of the cerebral substance, exhibiting itself in the form of a rent or fissure, often several inches in length. Such an occurrence is by no means uncommon at the base of the brain from fracture by contre-coup, as happens when a person falls from a great height and alights upon the top of the head. A severe wound of the brain is sometimes caused by depressed bone, or by a spicule of bone driven down into the substance of the organ. Punctured wounds in the adult are generally confined to the anterior lobes of the brain, and are usually inflicted with narrow, sharp-pointed instruments, such as a fork, pen-knife, stick of wood, dirk, bayonet, and the like, thrust across the orbital plate of the frontal bone. Children, before the completion of the ossific process, may be injured in a similar manner through any portion of the skull. Some years ago a case was communicated to me of a punctured fracture of the skull, penetrating deeply into the brain, in a lad six years old, from a long nail. The child, in falling from a considerable height, struck the top of his head against the nail, which was thus driven nearly two inches into the left hemisphere. In another case, which came under my own observation, in consultation with Dr. Rogers, a little boy fell, head-foremost, upon the point of an iron fence rail, receiving a frightful wound upon the brain, and literally empaling himself. The cranial bones were extensively comminuted, and a large quantity of brain escaped during the removal of the loose fragments. Convulsions soon followed, and recurred, with more or less frequency and violence, up to the time of death, eighteen hours after the accident. The brain is sometimes traversed from one extremity to the other by a ball, bayonet, or tamping-iron, as in the famous New England case, previously referred to. Occasionally, again, the vulnerating body is retained in the organ. Thus a ball, the but-end of a pistol, pieces of iron, fragments of bone, and various other substances, have been found within the skull, in contact with the surface of the brain, or lodged more or less deeply in the cerebral substance. What is remarkable, in such cases, is that the extraneous matter does not always speedily cause death. A few instances are upon record of balls having become encysted in the brain, so as to be afterwards comparatively harmless. The usual tendency, however, of such bodies is to excite fatal inflammation.

But the most formidable wounds of the brain are those generally which accompany compound fractures of the skull and extensive laceration of the meninges. They are usually of a lacerated and contused

nature, are apt to be followed by copious hemorrhage, and are frequently attended with pulpification and disintegration of the cerebral tissues, which sometimes escape in large quantity.

The *symptoms* and effects of wounds of the brain vary according to the extent of the lesion, and also according to the particular parts implicated. When the wound is comparatively small, and the cerebral substance is not too much mashed or contused, recovery is altogether within the bounds of possibility, and may, under judicious management, take place even readily. The great danger to be apprehended, in all cases, is encephalitis, with the formation of fungus, or protrusion of a portion of the brain. The mind is not necessarily affected, and the patient often recovers without any untoward symptoms. When the accident is more severe, the danger will, of course, be greater; but even here it is wonderful what little disturbance sometimes follows in cases apparently the most desperate. We see occasionally large quantities of cerebral substance lost, and yet the patient make a most excellent recovery, his intellect not only not being weakened, but, perhaps, improved by the occurrence. Such cases are, of course, uncommon, and are chiefly interesting as serving to show the extraordinary resources of the system in surmounting the effects of some of the most frightful accidents that can befall the human body.

When the wound involves the base of the brain, or the superior portion of the spinal cord, life may be destroyed in an instant by an arrest of the functions of the respiratory nerves. The intellectual faculties are also more deeply affected, if not completely annihilated, and ultimate recovery is doubtful in any case, however simple. If the patient be so fortunate as to escape with his life, he will afterwards suffer from loss of bodily and mental power; the mind will be permanently crippled, some of the special senses will be weakened, if not abolished, and the limbs will be affected with paralysis and contraction, followed sometimes by the most disgusting deformity. Epileptic convulsions are of frequent occurrence in such cases.

Wounds of the cerebellum are often followed by priapism and other evidences of inordinate sexual excitement.

The *treatment* of wounds of the brain and its envelops must be conducted upon the most rigid antiphlogistic principles; great care, however, must be taken not to carry this plan too far, for it should be recollected that a certain amount of inflammation is absolutely necessary to insure the restoration of the injured structures. If, therefore, the depletion be pushed to an inordinate extent, the system may be so far exhausted by it as to be unable to furnish the parts with the requisite supply of blood and plasma to carry on the work of repair. Besides, it can hardly be doubted that very active measures, tending to add still further to the debility of the patient, can fail to prove prejudicial, by abstracting unduly the nervous influence of the brain, and thereby seriously retarding, if not altogether preventing, recovery. On the other hand, too much forbearance must be equally disadvantageous. Hence, he will best discharge his duty who steers a strictly middle course, neither giving too much freedom to his hands, nor exhibiting too much inactivity. Having removed all extraneous sub-

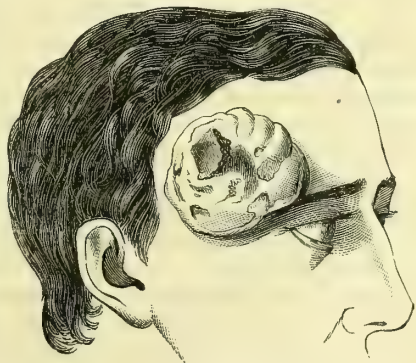


stance, and placed the parts, provided they are accessible, as nearly as possible in their natural relations, the patient is carefully watched, any tendency to over-action being at once arrested by the lancet, leeches, and other means. Early recourse is had, in all cases, to active purgation, the best articles for the purpose being calomel and jalap, or infusion of senna and sulphate of magnesia. When the patient has difficulty in swallowing, stimulating enemata must take the place of cathartics. Vomiting must, of course, be carefully guarded against, but where there is great dryness of skin, conjoined with an active pulse and excessive restlessness, there is no remedy more likely to promote perspiration, subdue vascular excitement, and to tranquillize the system than tartar emetic in union with morphia. I am never afraid to employ either of these articles in wounds of the brain, after the system has been properly reduced by bleeding and purgatives, or where these means are rendered unnecessary in consequence of previous shock and loss of blood. The head being well shaved, is thoroughly elevated, and kept constantly wet with a bladder partially filled with pounded ice. Starvation is not carried too far, lest it should create irritability in the heart and brain; at the same time great care is taken that the diet is perfectly simple and non-stimulant. All excitement is avoided, both during the active treatment and for a long time afterwards.

## FUNGUS OF THE BRAIN.

This affection, which is sometimes, ridiculously enough, called hernia of the brain, consists in a protrusion of cerebral substance through an opening in the skull, accompanied by a laceration of the brain and its envelops. It occasionally follows caries of the cranial bones and disease of the dura mater. One of the worst cases that I have ever seen was produced by syphilitic ulceration of the skull. When it supervenes upon external violence, it generally makes its appearance within a few days after the accident, and sometimes, indeed, almost immediately, especially when the cerebral lesion is unusually extensive. Its progress is commonly very rapid, the growth often attaining the size of a hen's egg in less than a week. Pressure has a tendency to restrain it, and to limit its bulk. The form of the tumor bears a considerable resemblance to that of a mushroom, the expanded portion overhanging the skull, while the narrow, projecting through the abnormal opening, is connected with the brain below. Its surface is rough, incrustated with lymph, and bathed with ichorous matter; in some cases it is studded with fungous granulations. The appearances of cerebral fungus are well illustrated by the adjoining cut (fig. 150), from

Fig. 150.



one of my patients. The fracture was situated at the outer and inferior portion of the frontal bone.

If a section be made of the fungus, it will be found to be composed of a mixture of cerebral substance and coagulating lymph, sometimes the one, sometimes the other predominating. When the growth is recent and rapid, it is not unusual for it to contain small masses of clotted blood, similar to apoplectic depôts of the brain. Its structure is usually very vascular, and hence it often bleeds quite freely when cut, or even when roughly handled. Destitute of sensibility, it is elastic and compressible, moving synchronously with the pulsations of the brain. That this tumor is not composed entirely, or even in great measure, of cerebral matter, as has sometimes been supposed, is proved by the circumstance that, after death, the loss of brain does not at all correspond with the volume of the morbid growth and the repeated retrenchments to which it was subjected during life. If this were the case, we should often find the greater portion of one entire lobe destroyed, or, at all events, an immense cavern in the affected hemispheres; but such, except in a few rare instances, is not the fact. The cerebral tissues around the tumor are always softened, discolored, and more or less infiltrated with serosity.

It is impossible to confound this morbid growth with any other; its history, the rapidity of its development, and the peculiarity of its shape, being always sufficient to mark its character. The symptoms which accompany it are variable. The discharge is usually of a thin, ichorous nature, quite profuse, and excessively fetid. Frequent bleeding occurs. The mind is sometimes affected from the very first; at other times it remains perfectly clear and calm for days and weeks. In general, however, there is considerable cerebral disturbance, as is indicated by the delirium and by the incoherent answers of the patient; the countenance has a peculiarly vacant expression; the skin is dry and harsh; the pulse, seldom normal, is either too frequent, or, as more commonly happens, too slow; the secretions are deranged; the bowels are constipated; and the sleep is interrupted by frequent starts and twitches. As the disease nears its close, coma and convulsions set in, and the patient dies, gradually exhausted, from nervous irritation. Recovery is an extremely rare occurrence in any case, however simple.

In the early stage of this affection, before the tumor has made much progress at extrusion, well conducted, systematic compression constitutes the prominent feature of the *treatment*. The object is to restrain the growth, and to circumscribe its limits. The pressure is made with a piece of sheet lead, a compress, and a roller, changed as often as may be necessary to insure firmness and cleanliness. As the mass recedes, the compress is gradually pushed into the osseous opening, until it is reduced to the level of the brain. To prevent relapse, the pressure is steadily maintained, now, of course, more gently, up to the very point of cicatrization. When, through neglect or mismanagement, the protrusion has attained considerable bulk, the proper plan is to excise all that is accessible, or to destroy it with the Vienna paste, or, what I prefer, the actual cautery, the parts being afterwards

protected in the manner just indicated. When the discharge is very offensive, free use must be made of the chlorides. The patient's strength must be supported by tonics and a mild but nutritious diet. The head must be maintained in an elevated position, and all excitement must be carefully avoided. Sometimes the fungous mass, becoming strangulated by the edge of the orifice in the skull, loses its vitality, and sloughs off; rarely, however, with any permanent advantage.

#### CHRONIC HYDROCEPHALUS AND TAPPING OF THE SKULL.

The surgeon is occasionally called upon to give his opinion respecting the treatment of chronic accumulations of water in the head, technically denominated hydrocephalus, or dropsy of the brain. The disease is fortunately a rare one, for it is nearly always fatal, whatever mode of management may be adopted for its relief. In regard to its pathology, there has been much diversity of opinion; my own belief, founded upon a careful observation of a considerable number of cases, is that the disease essentially consists in subacute, chronic arachnitis, commencing generally some time before birth, and going on gradually increasing until the head attains an enormous volume, causing hideous deformity. It would, perhaps, be wrong altogether to deny that the affection may not occasionally commence after birth, but if such an event does happen, it must be very uncommon. For, even when a child thus affected is apparently healthy when ushered into the world, well-marked signs of the disease usually manifest themselves so soon afterwards as to lead to the conviction that its origin was laid during intra-uterine life, probably in some inscrutable vice of the constitution.

The *fluid*, which consists almost wholly of water, with some of the earthy salts, but hardly any albumen, usually occupies the ventricles of the brain, which, as the accumulation augments, becomes at length completely unfolded, forming a layer perhaps not more than from three to six lines in thickness, in which it is difficult, if not impossible, to distinguish the white and gray substance. In some instances, it is situated in the arachnoid sac, on the surface of the brain, and when this is the case, the organ, in consequence of the severe and long-continued pressure of the water, is generally very much atrophied and distorted. I have not met with any examples in which the fluid was lodged between the cranium and the dura mater, and doubt very much whether it ever occurs here. Indeed, how could it get here, if we assume, as we certainly must, that the water is furnished by the arachnoid membrane? The dura mater has no such power, any more than any other fibrous tissue.

The *quantity* of water varies from a few ounces to several quarts. Cases have been reported in which upwards of fifty ounces were drawn off in one operation during life, and more than twice that amount has occasionally been found on dissection.

The disease is always *chronic*, and, if permitted to proceed, often continues for a number of years before it proves fatal. The general health, however, usually begins to suffer at an early period; the child

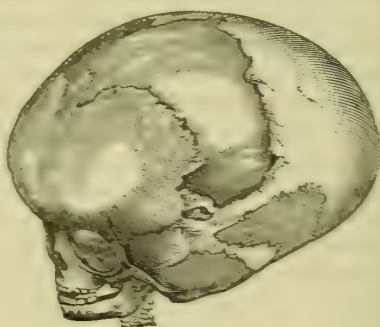


becomes thin and emaciated, loses its control over its muscles, and requires to be fed, although the appetite may be quite voracious. Convulsive twitchings are of common occurrence, the eyes roll constantly about in their sockets, the pupils are dilated, speech is absent, and the urine and feces commonly flow off involuntarily. The head, in the more advanced stages of the disease, is sadly misshapen, and altogether too heavy for the weakened body. The fontanelles are wide open, the cranial bones are abnormally thin and expanded, almost like parchment, and the subcutaneous veins of the scalp are enormously enlarged. In general, the mind is idiotic, and existence purely vegetative. The peculiar appearances of the head in hydrocephalus are well seen in the accompanying drawing (fig. 151), from

Fig. 151.



Fig. 152.



one of my clinical cases. Fig. 152 exhibits the state of the bones and fontanelles, divested of their soft parts.

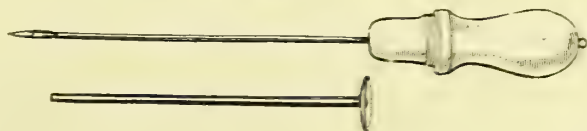
The *treatment* of this disease could not possibly be more discouraging. A cure, it is true, occasionally occurs, sometimes spontaneously, as after a violent attack of diarrhoea, or a course of active purgation, but the event is so uncommon as only to prove the exception to the great law which, at no distant period, inevitably consigns the patient to his grave. In such a work as this, it is not worth while to give even an outline of the leading plans of treatment that have been proposed for the relief of this affection, inasmuch as there is not a solitary one deserving of the slightest confidence. In the milder cases, especially in their earlier stages, some benefit may sometimes be derived from the steady use of sorbefacient applications to the head, as iodized unguents or lotions, and the exhibition of iodide of potassium and bichloride of mercury, aided by an occasional laxative, and a properly regulated diet. Shaving the scalp, and afterwards vesicating it with cantharides has sometimes seemed to prove beneficial. No advantage could reasonably be expected from counter-irritation by a seton, or issue in the nape of the neck. Regu-

lar, systematic compression has repeatedly been tried, either with adhesive strips, or the roller, or both together, and a few cases have been reported of its supposed efficacy. Usually, however, the cure is but temporary, and it is proper to add that the treatment is often followed by convulsions, thus necessitating its abandonment.

*Puncture* of the cranium, first proposed by Dr. Vose, of New York, has often been practised, and, if we were to credit the statements that have been published on the subject by certain physicians, we could hardly fail to award to it the praise of extraordinary merit. Thus, one gentleman, Dr. Conquest, asserts that he has cured not less than ten cases out of nineteen. Dr. West has collected sixty-three cases in which the head was tapped by different surgeons, of which eighteen, or two out of seven, are said to have terminated successfully. I must confess, however, my disbelief in all these statistics, convinced that they are unreliable, not because of any wilful misrepresentation on the part of the reporters of the cases, but simply because they either deceived themselves, or allowed themselves to be deceived by others. I have myself never heard of a radical cure effected in this way. In the only two cases in which I have performed the operation, death in each ensued in less than four days from convulsions; and such must, I am satisfied, generally be the result, especially when the accumulation is at all considerable, however carefully the treatment may be conducted after the evacuation of the fluid. It requires no argument to show that life cannot be long supported when such an amount of pressure as attends confirmed dropsy of the brain, is suddenly taken off from so important an organ.

The puncture is made with a very delicate trocar (fig. 153), intro-

Fig. 153.



duced some distance from the longitudinal sinus, and closed as soon as about two-thirds of the water have been evacuated, with collodion and adhesive plaster, which should be extensively applied with a view of compressing the skull. The operation may be repeated once a week.

#### BANDAGING OF THE HEAD.

For simply retaining dressings, cataplasms, and lotions upon the head, the best contrivance generally is a light handkerchief, arranged in the form of a nightcap, or a nightcap itself. The handkerchief being folded into a triangle, the centre of the base is applied to the forehead, and the body to the vertex, the tail hanging back over the neck. The side ends lying upon the cheeks, are then carried backwards over the ears, crossed at the occiput and tied in front, an inch

above the nose, as represented in fig. 154. Where greater nicety is required, as when the object is to make moderate, but equable compression, a double-headed roller should be used, after the fashion shown in fig. 155. Its application is thus described by Mr. Lonsdale.

Fig. 154.



Fig. 155.



"The centre of the roller is placed low down on the forehead, and the two heads are carried back and made to cross low down beneath the occiput. One head is then brought over the vertex, while the other is carried horizontally round to lap its extremity; and this, turned up over the horizontal one, is carried back to the occiput, slightly overlapping the former vertical band. At the occiput, the heads are again crossed, the surgeon shifting his hands for the purpose, and a third turn is made on the other side of the vertical band, while a third horizontal round secures it as before. This is continued until the whole head has been uniformly invested."



## CHAPTER III.

## DISEASES AND INJURIES OF THE SPINAL CORD AND COLUMN.

THE most important surgical affections of the spinal cord are concussion, compression, inflammation, and wounds. The vertebræ are subject to curvature, tuberculosis, and congenital clefts, attended with protrusion of the arachnoid membrane, and constituting what is called hydrorachitis.

## CONCUSSION.

Concussion of the cord is produced by accidents similar to those which occasion concussion of the brain, as blows or falls upon the back, head, feet, or nates. The severity of the effect is usually in direct proportion to the directness of the injury; but the most violent and protracted case of concussion of the spine I have ever seen was caused by a fall, in an elderly gentleman, upon the buttock, from a height of about ten feet, down upon the floor. The affection exists in various degrees, and probably does not always affect the entire cord, being limited to particular tracks of it, or concentrated with special force at particular points. However this may be, the symptoms are commonly quite characteristic. The patient feels sick at the stomach, looks excessively pale, and is altogether helpless, his body being more or less paralyzed. A sense of formication, stinging, or prickling is experienced along the spine and in the extremities; the sphincters are relaxed, and, in the more severe cases, there are apt to be involuntary discharges from the bladder and bowels. Death may occur from the severity of the injury within a short time after its infliction; or, reaction taking place, the effects of the concussion may gradually pass off, the limbs regaining their functions and the sphincters their power of action. In some cases, however, the mind remains bewildered for a number of days, the patient being partially delirious, but yet not sufficiently so as to prevent him from washing and shaving himself, or even, perhaps, attending to business. Another remarkable symptom, which I have occasionally witnessed, after recovery from the more immediate effects of the injury, is excessive irritability of the bladder, attended with an almost incessant desire to pass water, which is generally greatly increased in quantity.

The *treatment* of concussion of the spinal cord must be conducted upon the same general principles as that of concussion of the brain; by recumbency and cordials, or mild stimulants, during the stage of depression, and by great vigilance during the period of reaction, lest it should transcend the healthy limits and pass into inflammation. Should

this untoward circumstance arise, it must be promptly met by the usual antiphlogistic means. A full anodyne, with the addition of a little tartrate of antimony and potassa, will generally speedily arrest the irritability of the bladder and the tendency to inordinate renal secretion.

#### WOUNDS.

Wounds of the spinal cord may be of various kinds, and are extremely apt, even when of small size, to eventuate fatally, in consequence of their liability to be followed by inflammation and softening of the proper nerve-substance. Copious hemorrhage sometimes attends them, still further complicating the case, by inducing severe, if not irremediable, compression. Very terrible effects are also frequently caused when the accident is accompanied by fracture of the vertebræ, with depression of the bone, which is sometimes driven across the cord in such a manner as to divide it as completely as if it had been done with a knife. At other times, small fragments of bone are buried in the substance of the cord. Paralysis, partial or complete, temporary or permanent, necessarily attends all lesions of this description. If the injury is very considerable, it may destroy life on the instant, especially when it occurs above the origin of the phrenic nerves.

The following case of *gunshot wound* of the spinal cord, which I attended with Dr. Thomson, in 1854, will afford a further illustration of this class of injuries: A gentleman, aged 29, was shot in the back with a pistol, the ball entering the left shoulder, about two inches and a half below its top, and four inches and a half from the middle line. The man instantly fell, as if he had been struck upon the head, and for a moment it was thought that he was dead. It was ascertained, however, that he had merely sustained a violent shock; there was but little bleeding, and reaction soon followed. Intoxication existing at the time of the accident, it was impossible to make out a satisfactory diagnosis. The hands could be moved, but the lower extremities were completely useless. The next morning, when the effects of the liquor had passed off, it was found that his body and legs were completely paralyzed, and that he was deprived of sensation all the way down from near the top of the sternum to the soles of the feet. The pulse was remarkably slow, and the breathing heavy and laborious. The bowels were costive, and the bladder had to be relieved with the catheter. The mind was clear and composed. These symptoms continued until he died, at the end of three days and a half. On dissection, it was discovered that the ball had entered the spine, between the last cervical and first dorsal vertebræ, penetrating and pulpifying the cord, and cutting it in two by projecting across it a fragment from the injured bones. It was found loose in the vertebral canal.

In regard to the *treatment* of wounds of the spinal cord, nothing of a definite character can be suggested; every case must be managed according to its own peculiar nature. The great object, of course, should be to moderate inflammation, and to prevent effusion and other ill effects. If foreign matter is present, pressing upon the cord, it should, if possible, be removed, though in attempting to do this there

is great risk of increasing the original mischief. Trephining will not be likely to be of any service; the operation has been tried in a number of cases in depressed fracture of the vertebræ, but in none has it ever been productive of any benefit.

Inflammation of the spinal cord, technically called *myelitis*, is rather a medical than a surgical subject, and may, therefore, very properly be passed over in a work of this kind.

#### LATERAL CURVATURE.

Lateral curvature of the spine is a very different affection from curvature produced by caries of the vertebræ; in the latter, the distortion is antero-posterior, and is essentially dependent upon organic disease of the osseous tissue; in the former, it is sideward, and is caused by irregular muscular contraction, acting upon weakened bones, fibro-cartilages, and ligaments, dragging them out of their natural position, and so inducing more or less deformity.

The *causes* which give rise to this irregular action on the part of the muscles, enabling those of one side of the middle line to overpower those of the opposite side, and so establishing a tendency in the spine to deviate from the straight position towards the side of the stronger muscles, are of a diversified character, and possessing, as they do, important therapeutic relations, are deserving of attentive consideration. These causes may be conveniently arranged under the following heads: 1. Affections of the muscles, as hypertrophy, atrophy, inflammation, and spasmodic contraction. 2. Debility, either general or local. 3. Obliquity of the pelvis, from injury or disease of the inferior extremities. 4. Altered capacity of one side of the chest, causing increased action of the muscles of the opposite side. 5. Rachitic softening of the bones. 6. Defective development of the vertebræ.

*Hypertrophy* of the muscles, as a cause of spinal curvature, may be induced in a variety of ways; often simply by excessive use of one arm, in the exercise of a particular avocation. Blacksmiths, composers, tailors, seamstresses, and dragoons are remarkably prone to this form of spinal disease. It is a law of the animal economy that muscles grow and expand in proportion as they are exercised. Hence, if, for example, the muscles of one arm are more developed than those of the other, the necessary result will be a loss of equilibrium, on the principle that the stronger always overpower the weaker, and, therefore, just in proportion as this preponderance of action exists on one side will the spine, if the muscles so affected are attached to it, be drawn over towards that side. The muscles which are most liable to inordinate development from this cause, are the trapezius and rhomboid, which, acting directly upon the spine, completely overpower their fellows of the opposite side, causing thus a marked curvature, the convexity of which corresponds to the hypertrophied limb.

An effect similar to the above is sometimes produced when the muscles of one side of the spine become atrophied while those of the opposite side retain their healthy condition. The balance between



them being thus destroyed, it is easy for the muscles which possess the preponderance of power so to act upon the vertebral column as to induce more or less lateral displacement.

Similar consequences ensue when the muscles become disabled by *inflammation*, as occasionally happens in rheumatism; or by paralysis, as in severe contusions, and in failure of nervous influence; or by spasmodic contraction, as in wry-neck, which, whenever it exists in a high degree, is always accompanied by curvature of the cervical portion of the spine, occasionally in a very high and distressing degree.

*Debility* of the muscles is a very frequent cause of spinal curvature; undoubtedly the most frequent of all. It may be general, or local; in the former case, affecting all the muscles, not only of the back, but of the rest of the body, in the latter, chiefly the spinal muscles. Any circumstance that depresses the vital powers must necessarily weaken the muscular system, and lead to irregularity of action, disqualifying it for the due performance of its functions. Lateral curvature of the spine may often readily be traced to the debility occasioned by protracted fever and exhausting discharges. The patient, on recovering from his attack, finds that the muscles of the back are too feeble to sustain the spinal column in the erect position, and that, consequently, when he begins to walk, it is drawn towards one side, which is always in the direction of the muscles having the preponderating influence. Effects of a like character are produced by the use of unwholesome food, starvation, and inadequate clothing, eventuating in an impoverished and anemic state of the system.

Among the more common exciting causes of local debility, considered in its relation to spinal curvature, are *fatigue* of the muscles of the back from the protracted maintenance of the erect posture, and arrested growth from tight lacing. The evil effects produced by sitting daily for a number of consecutive hours, without any support for the spine, are well exemplified in young ladies at fashionable boarding-schools, and in young female operatives in crowded factories. The erector muscles of the spine being continually kept upon the stretch, soon become exhausted, and by the constant repetition of the abuse are ultimately entirely disqualified for their task. If the child happen to be naturally feeble, or if she have become so by disease, the consequences of this practice are frequently most pernicious, the vertebral column being not only distorted laterally, but twisted more or less upon its axis.

The effects of *tight lacing* are known to every surgeon, not merely in their relation to spinal curvature, but in their influence upon the general health. There is not an organ of the body that is not injuriously affected by the corset, or that does not resent the "vile encroachment." Circulation, respiration, digestion, and secretion are all brought under its dominion. The muscles of the back are seriously restrained by it. Hence, if the practice be continued for any length of time, they must necessarily become stunted in their growth, and irregular in their action, unfitting them for the healthful discharge of their respective functions, those of one side being rendered stronger than their fellows of the opposite side, and so dragging the spinal column out of place.

Obliquity of the *pelvis* is invariably followed, if long continued, by lateral distortion of the spine, particularly in the lumbar region. A good illustration of this coincidence is afforded in diseases and accidents of the hip-joint, in which, in order to throw the weight of the body upon the sound limb, the pelvis of the affected side is elevated, and a curve is formed in the loins, by the constant strain upon the spinal muscles. Affections of the knee-joint give rise to similar effects.

The effect of an altered state of the *chest* in producing spinal curvature is well exemplified in what occurs in empyema and chronic pleurisy, where, in consequence of the compression and obliteration of the bronchial tubes, and the extensive morbid adhesions between the pulmonary and costal pleuræ, the ribs sink in and lie almost in contact with each other, thus greatly diminishing the capacity of the thorax of the affected side, while that of the opposite side is proportionably increased. The shoulder corresponding with the seat of the disease is notably depressed, and its muscles are so much weakened as to permit their fellows on the other side to draw the spine over in that direction.

*Rachitis* is a common cause of lateral curvature of the spine, the bones being so weak as to be incapable of withstanding the action of its several muscles. This disease, which is essentially of an inflammatory nature, and which is almost peculiar to early childhood, is characterized by a great deficiency of earthy salts, in consequence of which the different pieces of the skeleton are rendered so soft and flexible as to permit themselves to be cut and bent in almost every direction. The vertebral column, of course, participates in the morbid action, and hence it is easy to perceive how it must be affected by the various muscles which naturally influence and control its movements. Some of the very worst examples of curvature that we meet with are produced in this manner, the spine being drawn not only sideways but backwards.

Finally, lateral curvature may be caused by defective development or *malformation* of the vertebræ, some of the individual pieces being either too small or too large, or so united as to meet only at particular portions instead of at their entire surface, as in the natural state. The consequence of this arrangement is that the muscles of the spine, intent upon regaining their equilibrium, soon act unequally, those on one side overpowering those of the opposite side; not uniformly, but at different points, so as to induce, perhaps, the very worst form of distortion.

The *extent* of the curvature produced by these different causes is variable. Thus, it may be limited to one particular region, or it may involve one-half, two-thirds, three-fourths, or even the entire length of the spine. When the affection is very extensive, the curvature presents itself in the form of an Italic *f*, compensating curves being formed on the opposite sides. In the more common cases of lateral curvatures the deformity begins in the upper dorsal vertebræ, on the right side, in an abnormal development of the deltoid, spinatus, trapezius, and rhomboid muscles, which, overpowering their congeners of the opposite side, gradually drag the bones and everything that is connected with

them over in the contrary direction, thus forming the first or middle curve of the series. The equilibrium between the muscles being thus destroyed, nature is not slow in her efforts at restoring it; but the only way in which she can accomplish this is by forming compensating curves, of which there are generally two, one in the lumbar region and the other in the cervical, their development usually occurring simultaneously, and, of course, in a direction opposite to the primary. There are instances, however, although they are rare, in which one continuous curve exists on one side, evidently depending upon paralysis of the muscles on the opposite side. A sigmoid curve can never rectify itself, and hence such cases are often irremediable, simply because it is impossible to establish a counterbalancing power in the congenerous muscles. The external characters of lateral curvature of the spine are well displayed in the adjoining cuts (figs. 156 and 157).

Fig. 156.



Fig. 157.



Lateral curvature, in its more aggravated states, is always attended with marked rotation of the spine, the rotation existing in the direction of the convexity of the curvature; the vertebral column is diminished in length in a degree proportionate to the lateral deviation, and the chest is materially altered in its figure, the ribs being flattened, elongated, and twisted, and the sternum and costal cartilages tilted prominently forwards, and depressed towards the pelvis. The scapula on the side corresponding to the convexity of the thoracic curve is unnaturally large and elevated; its upper border is directed forwards and inwards, while the inferior angle is carried outwards, and hangs off in a very unseemly manner from the side of the chest, in consequence either of the elongation of the latissimus muscle, or on account of the escape of the bone from beneath its surface. A lumbar curve always gives



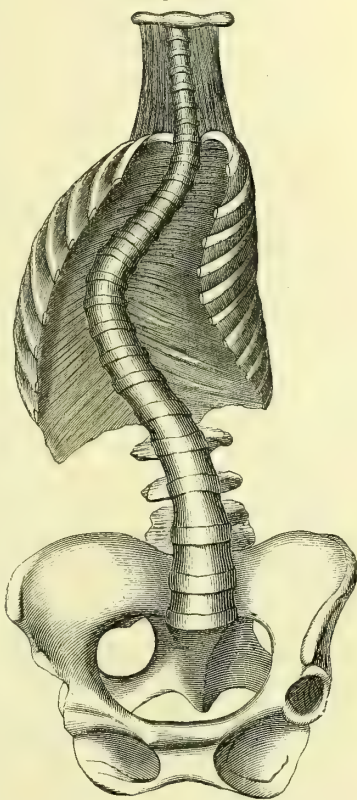
rise to obliquity of the pelvis, and a cervical one, to obliquity of the head; so that there is occasionally, in reality, a quintuple curve. In the earlier stages of the affection, the curvature is effected chiefly at the expense of the intervertebral cartilages and ligaments; but as it advances, the bones themselves become involved in the disorder, some portions being absorbed, and others strengthened, by the addition of new osseous matter.

The annexed drawing (fig. 158), from a preparation in my collection, affords an excellent exhibition of the vertebræ and ribs in the milder forms of lateral curvature.

The *symptoms* of lateral curvature of the spine are subject to considerable diversity, depending mainly upon the extent and duration of the lesion. In general, they are such only as are denotive of functional disturbance of the thoracic and abdominal viscera. In the milder cases, the patient experiences merely some degree of inconvenience in walking, becoming easily fatigued during exercise, and suffering from occasional palpitation of the heart, with, perhaps, some degree of uneasiness in breathing. Gradually, however, the general health begins to fail; progression, and the maintenance of the semi-erect posture become more and more irksome; gastric and intestinal derangement supervene; the bowels are apt to be constipated; pains are complained of in the side and back; dysmenorrhœa is often present; and the countenance exhibits a pale, care-worn, and chlorotic appearance, indicative of the crowded and compressed condition of the thoracic, abdominal, and pelvic organs.

Lateral curvature of the spine, to a slight degree, exists in almost all persons on the right side, owing to the fact that nearly every one naturally uses the right arm more than the left. Hence, the corresponding muscles are always more developed, and, acting with more vigor than their congeners, usually draw the dorsal, or dorso-cervical region, a little over to the right; hardly, however, to an extent sufficient to deserve the name of disease. Considered as a morbid affection, it is most commonly observed in young girls, from the age of five to fifteen or eighteen, especially in such as are naturally of a feeble constitution, or whose health has become early impaired by want, exposure, and imperfect nutrition.

Fig. 158.



The *prognosis* of lateral curvature is generally favorable when the affection is recent, of slight extent, and met with in a person of comparatively healthy constitution. Proper management, under such circumstances, will usually effect complete restoration, although the treatment will require time and perseverance. Not unfrequently the mere rectification of a bad habit, causing an unnatural strain upon a particular set of muscles, will remove the complaint. When the affection depends upon extensive paralysis of the spinal muscles, organic disease of the vertebræ or their cartilages and ligaments, or serious lesion of the pelvis, hip, or knee, great improvement may be effected, but a complete cure will be difficult, and probably impracticable. The prognosis is also unfavorable in cases of long standing.

The *treatment* of lateral curvature must be governed, in great degree, by the nature of the exciting cause; hence, before any measures are instituted for its relief, the most careful inquiry should always be made with reference to this particular circumstance. So long as the cause under whose influence the disease has been developed is permitted to continue in operation, so long, it is obvious, will it be impossible to make any favorable progress towards a cure. A primary object, therefore, in every case, is to ascertain, if practicable, what has given rise to the affection, and then to shape our conduct accordingly.

The mere discontinuance, temporary or permanent, of a particular avocation, will often speedily overcome the affection, by enabling the muscles of the two sides of the vertebral column to regain their equilibrium, upon the loss of which the trouble depends. Thus, the lateral curvature which results from hypertrophy of the muscles of the right shoulder and arm of the blacksmith, from a disproportionate use of the other limb, may eventually be completely removed, if early attended to, before there is any structural change in the bones, cartilages, and ligaments, simply by transferring the hammer to the left hand. The steady, daily exercise of the left limb will soon bring out the full strength of its muscles, while those of the right arm, now comparatively quiet and inactive, will gradually be reduced in volume and force, and so in time permit a restoration of the balance of power, and, along with it, a return of the spine to the straight position.

The lateral curvature of the spine, contracted by girls at school and by children at factories, in consequence of a vicious habit of sitting, standing, or reclining, by which the vertebral muscles lose their equilibrium, can be successfully cured only by a reference to the nature of the exciting cause. The awkward and constrained position must be promptly rectified, and means adopted to improve the general health, when this has been suffering, by gentle exercise in the open air, sea-bathing, the cold shower bath, and a properly regulated diet. Great attention must be paid to the gait in walking, so as to bring into full play the enfeebled and faulty muscles; the spine should be well supported while in the erect position by a light and well adjusted brace; and the child should be requested to lie down frequently during the day, in order to afford complete relaxation and rest to the entire system, so conducive to comfort and the restoration of vigor.

When the affection is manifestly dependent upon debility, or want

of tone in the general system, tonics will be indicated, and should be of such quality and given in such quantity as may be calculated to improve rapidly the condition of the blood and solids. The various chalybeate preparations, either alone or in union with quinine or Huxham's tincture of bark, generally produce an excellent effect, and should be administered, steadily and persistently, for several successive months; the dose being occasionally varied, or a new article added, to relieve the monotony of the treatment. When marked emaciation exists, cod-liver oil will come in play, and will often rapidly improve both flesh and strength. The diet should be judiciously regulated; it should be perfectly plain and simple, but at the same time sufficiently nutritious in the smallest compass, so as not to crowd the stomach and bowels, and so interfere with the movements of the diaphragm and the expansion of the lungs. Fresh milk and sweet cream should be freely used, together with an allowance of brandy, wine, porter, or ale, suitable to the age and condition of the patient. Frequent ablutions with strong soap and water, or some other alkaline solution, followed by dry friction, the occasional employment of the shower bath, and gentle exercise in the open air, or, when this is impracticable, swinging in a hammock, the body being in a perfectly passive condition, will be valuable adjuvants, and should be diligently enforced. Shampooing the back, practised twice daily for thirty minutes at a time, is often of signal benefit in imparting tone and energy to the weakened muscles, and seems to me to be deserving of more attention in this particular class of cases than it has hitherto received. When the muscles are exhausted by paralysis, the cold douche, the electric current, and gentle flagellation will prove useful, and may be employed conjointly with tonics and minute doses of strychnine.

Lateral curvature depending upon obliquity of the pelvis is not always curable, inasmuch as the cause itself does not invariably admit of removal. When this is the case, the weakened spine may be supported by appropriate stays, and by attention to the position of the body in progression, standing, sitting, and reclining. Similar means must be adopted when the fault lies in the chest, as in retrocession of its walls in consequence of empyema and pleuritic adhesions.

The treatment of rachitis, considered as a cause of spinal curvature, need not be particularly discussed here, inasmuch as it has received sufficient attention elsewhere. It is essentially an inflammatory affection, associated with, if not directly dependent upon, impaired nutritive action of the osseous tissue, attended with a deficiency of earthy matter, and consequent softening of the skeleton. The treatment must be alterant and tonic, and the spine must be mechanically supported until the bones have acquired a sufficient degree of solidity to enable them to resist effectually the influence of the muscles of the back.

Lateral curvature, dependent upon defective development of the vertebræ, requires early and persistent mechanical treatment, to sustain the weakened spine, and afford the affected parts an opportunity of being moulded into a more suitable shape for the due performance of their functions. The occurrence, which is, fortunately, very rare, is apt to be overlooked until it is too late to benefit the patient.



The treatment of lateral curvature, however induced, derives important aid, in almost every case, from mechanical support of the spine, and much ingenuity has been expended of late years in the invention of suitable apparatus, of which there is, consequently, a vast amount before the profession, all constructed upon the same principles, although possessing different degrees of merit. It may be stated, as a general rule, that the more light, airy, and simple such apparatus is, the more comfortable it is for the patient, and the better adapted to the removal of the distortion. It should consist of five principal pieces, as the necessary framework, of which two are horizontal and three vertical, connected together by screws and hinges. Of the former, one corresponds with the hips and the other with the shoulders; of the latter, two extend up along the sides of the trunk into the axillæ, their superior extremity being crutch-shaped for the more easy support of the arms, while the third, or intermediate one, rests upon the spine. The whole apparatus is well cushioned to ward off pressure, and is kept in place by straps and buckles. Counter-pressure may be made, if deemed advisable, upon the convexity of the thoracic curve, by means of an appropriate pad secured to the middle upright piece of the apparatus; and, when there is considerable displacement of the cervical vertebræ, a head-piece may be added.

The apparatus may be worn day and night; and, although it may at first prove irksome, yet such is the comfort derived from its use that the patient will soon be loth to be without it.

The bed upon which the patient lies should be furnished with a smooth and elastic mattress, in order that his body may not sink into any hollows or depressions, at the same time that it should be sufficiently soft to insure the requisite comfort. The object, however, of this arrangement is not to confine the sufferer to her bed beyond the hours which are necessary for a due supply of sleep and repose after exercise. In the antero-posterior displacement of the spine, or Pott's disease, rest and recumbency, absolute and unconditional, are enforced, and scrupulously maintained for many months; here, on the contrary, rest and recumbency, although highly important, are not trusted to alone, but are wisely conjoined with gentle exercise in the open air, either on foot, in a carriage, or on horseback, as may be found most convenient or suitable to the patient. The body, in short, must be invigorated, and the faulty muscles set in action by their appropriate stimulus, namely, motion, varied, diversified, and frequently repeated.

With out-door exercise is often advantageously combined a gentle course of gymnastics; but to derive full benefit from it, it should be conducted under the immediate superintendence of a regular master of the art, well acquainted with the exigencies of the case; otherwise immense harm instead of benefit will be likely to ensue.

A great deal has been said of late years respecting the beneficial effects of *myotomy* as a remedy for the cure of lateral curvature of the spine; and if the reports that have appeared in some of the periodicals of the day are to be trusted, it would seem that almost every muscle of the back, large and small, has been divided for this purpose. The exploits of Mons. Guérin upon this field have been quite of a Napo-

leonic character, and they would, doubtless, have conferred upon him immortal honors, had it not been discovered that such universal havoc was rather an injury than a benefit to his victims. What the result of a more calm and rational myotomy may ultimately accomplish for this class of patients, time alone can determine. Judging from the happy effects which have followed the procedure in wry-neck and strabismus, it might reasonably be concluded that it would also confer important service in lateral curvature of the spine, and such is certainly the opinion, at this moment, of some of the best surgeons in this and other countries.

## TUBERCULOSIS OF THE SPINE.

The bodies of the vertebræ being composed, in great measure, of areolar tissue, invested by a thin layer of compact substance, are liable to tubercular deposits, similar to those which are so frequently met with in the carpal and tarsal bones, and in the articular extremities of the long bones. The affection, from its destructive character, is one of very grave import, and has, therefore, always engaged the earnest attention of surgeons. It has been only, however, within a comparatively recent period that its true nature has been properly understood. It was reserved for Mr. Pott, towards the latter part of the last century, by a series of masterly observations and dissections, to point out its etiology, pathology, and treatment, and so completely did he exhaust the subject that nothing of any real importance has been added to our knowledge of it since his death. Indeed, so graphic is his account of the disease that it is now generally known by his name.

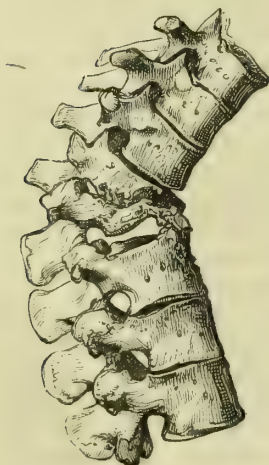
Although the disease may occur in any portion of the spine, yet it is much more common in the dorsal region than in either the cervical or lumbar, the second, third and fourth pieces being especially prone to suffer. It is generally stated that the lumbar vertebræ are more frequently affected than the cervical, but this I believe to be an error; at all events, my own practice has supplied me with a greater number of cases of the lesion in the latter than in the former. It is impossible to assign any reason why caries of the vertebræ should be so much more common in the dorsal region of the spine than elsewhere; but such is unquestionably the fact, and the circumstance is one of great importance, both in a diagnostic and practical point of view.

Pott's disease occurs in both sexes, in all classes of society, and at different periods of life, although it is much more common in children from the age of three to twelve years than at any other time. I have met with it as early as the fifteenth month, and cases are occasionally observed as late as the thirtieth, or thirty-fifth year, but these are rare, and must, therefore, be regarded as exceptions to a general law, which constitutes this a disease of early childhood. It is most common in the lower walks of life, among the ill-fed and half-starved occupants of the crowded lanes and alleys of large cities, and always recognizes, as its essential cause, a strumous state of the system. Like tubercular disease of the lungs, it is, in fact, merely a local manifestation of a

constitutional vice, or a general dyscrasia of the blood and of the solids. This, therefore, constitutes the great and fundamental principle of the disease; the indispensable condition of the system which precedes the outbreak of the local affection. External injury, exposure to cold, and various other depressing influences, may excite the disease into action, but no such occurrence could possibly happen from these or any similar causes, if no tendency to the disease existed in the constitution at the time of their application.

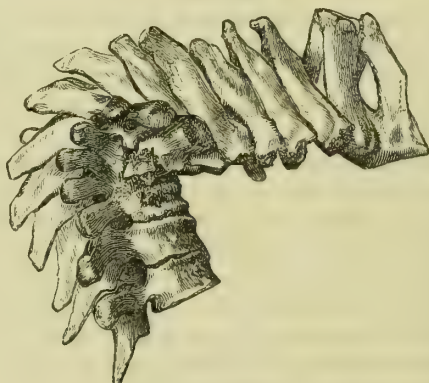
The tubercular matter, which is the immediate cause of caries of the spine, is deposited in the areolar structure of the bodies of the vertebræ, either as an infiltration or in the form of distinct, rounded masses, from the size of a millet seed to that of a pea, a few of which are sometimes encysted. It is not improbable that more or less is also occasionally deposited upon the surface of these bones, beneath the periosteum, in the substance of the periosteum, or in the interior of the intervertebral cartilages, or perhaps in all of these situations simultaneously or successively. How long it exists before it becomes softened and disintegrated, we have no means of knowing; the period, doubtless, varies in different cases and under different circumstances, but, on an average, it probably does not exceed five or six months, the substance obeying the same laws here as in other parts of the body. Be this as it may, when the process has once fairly commenced it generally proceeds very rapidly, so that it often produces very serious havoc in the course of four or five weeks, completely annihilating the affected structures, and causing great and irremediable deformity. If a dissection be made at this stage of the malady, a gap (fig. 159), the size of which corresponds

Fig. 159.



Caries of the vertebræ; macerated; the bodies extensively destroyed.

Fig. 160.



Angular curvature from caries.

with the number of vertebræ affected, will be found to exist in front of the spine, occupied by unhealthy, strumous matter, the debris of disintegrated bone, and fragments of fibrocartilage and thickened periosteum. The spinal cord and the roots of the spinal nerves will be observed to be more or less denuded,



and the remnants of the diseased vertebræ to be thrust backwards in such a manner as to cause an antero-posterior curvature, very marked behind, in consequence of the unnatural projection of the spinous processes (fig. 160). When the lesion is seated in the dorsal region, the adjoining ribs often participate in its ruinous effects, and the matter is sometimes extensively diffused over their internal surface, as well as over the anterior and lateral aspect of the spinal column.

The number of vertebræ involved in this disease is variable; sometimes it is limited to a single piece, but most generally it attacks two or three, the spongy substance of which, together with the intervening fibro-cartilages and the contiguous periosteum, is eventually completely destroyed.

The affection usually comes on in a slow and stealthy manner, and hence it often makes very serious inroads, both upon the part and system, before its true character is even suspected by any one. Among the earlier *symptoms* is an appearance of gradually declining health; the patient looks pale and feeble; his appetite and bowels are irregular; the gait is vacillating and tottering; the strength easily gives way under exercise; the lower extremities are the seat of numbness and occasional spasmodic twitching; a sense of pain and discomfort is felt along the spine, particularly at the affected part; the urine is alkaline and scanty; the sleep is disturbed by moans and restlessness; and there is not unfrequently a good deal of fever at night, followed, perhaps, by considerable perspiration towards morning. By and by the symptoms assume a more decided character. The pain in the back increases, and pressure upon the part generally causes a peculiar sickening sensation; a feeling of constriction is experienced in the chest, as if it were girded by a tight cord; the difficulty of walking rapidly augments; the general debility becomes more and more marked; and the numbness in the lower extremities, steadily advancing, is now generally conjoined with a disagreeable prickling feeling, evidently the result of pressure on the spinal cord. The paralysis accompanying the disease exists in various degrees; in some cases it is extremely slight, and hardly attracts attention; in others, on the contrary, it is so great as to deprive the patient completely of the power of progression. Usually motion is impaired before sensation.

The *deformity* of the spine is always characteristic; it is angular backwards, and varies in extent according to the number of vertebræ affected, and the duration of the disease (fig. 161). It is limited to the seat of the disease, and is often associated with a kind of knob-like enlargement of the neighboring parts, especially conspicuous when there is serious involvement of the ribs. In the more aggravated cases, the spine is bent back many inches beyond its natural level, the chest is singularly elongated in the antero-posterior direction, the sternum is pushed out in front, and the head is sunk down between the shoulders, causing that peculiar hump-backed appearance which forms so striking a feature in the symptoms of this disease in its confirmed stages. If the body be viewed in profile, the chest will be found to represent the outline of a triangle, the apex corresponding with the affected part, and the base with the sternum and costal cartilages. These appearances

are well represented in the annexed cut (fig. 162), from a preparation in the Mütter collection.

Fig. 161.

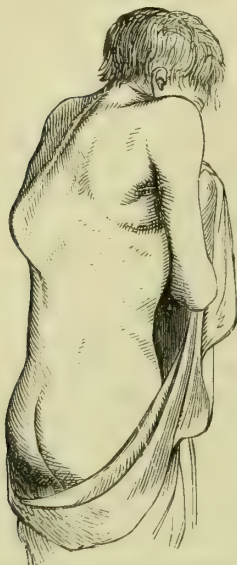
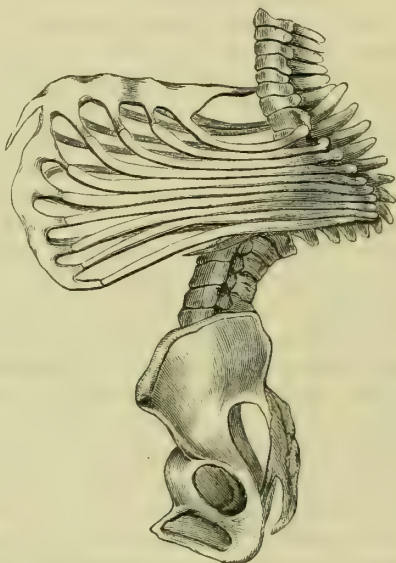


Fig. 162.



The matter which forms in this disease may be absorbed; or it may accumulate, and ultimately seek an outlet, either through the back near the seat of the disease, or it may gravitate along the front and sides of the spine, and eventually point in the groin, the lumbar region, or the upper part of the thigh. My experience shows that it is often completely absorbed during the progress of the case, and that even when it exists in considerable quantity.

A disease which makes such sad inroads upon the part and system as this is necessarily a grave disorder under any circumstances; but when it occurs, as it generally does, in children of a broken-down, miserable constitution, ill-fed and half-naked, or whose bodies are completely saturated with the strumous diathesis, the prospect of an ultimate cure must be very limited indeed. Many of such patients perish from hectic irritation, while the majority of those who recover are doomed to a wretched existence, permanently dwarfed, and hump-backed. In the better class of subjects restoration is the rule, death the exception; and it is well to know that, if the case be properly managed, excellent cures, with little or no deformity, may be made even when the disease has already produced considerable structural change.

When the disease is located in the cervical region, the prognosis is generally less favorable than when it affects the dorsal or lumbar; yet most extraordinary recoveries are now and then witnessed, the patient getting well apparently in despite of the malady. One of the most remarkable instances of this kind that I have ever seen occurred recently in a young man, a private patient of mine, who, notwith-

standing a most severe attack of caries of the superior cervical vertebræ, has got a very good use of the neck, although the upper portion is so completely ankylosed that, in attempting to look sideways, he is obliged to turn his whole body round. A great exuberance of callus has formed over the affected pieces, giving the neck a very full, heavy appearance.

When the cervical vertebræ are extensively affected, the disease not unfrequently proves fatal, death occurring in one of several ways. First, an abscess may form, and destroy life, either by bursting into the larynx, or into the spinal canal; in the one case instantly suffocating the patient, and in the other not less certainly killing him by inducing compression of the spinal cord. Secondly, dislocation of the odontoid process may occur in consequence of ulceration of the transverse ligament; and, lastly, life may be suddenly extinguished by injury inflicted upon the spinal cord, by the accidental giving way of some of the diseased vertebræ.

The manner in which the gap is filled up, when a cure is effected in this disease, constitutes one of the most interesting features in its history. As soon as the morbid action is arrested, nature sets up a process of repair, consisting, in the first instance, in an effusion of plastic matter. This often begins at one part, while the disease is still going on in another; a circumstance which greatly conduces to recovery, as much time is thus saved. The restorative process advancing, the plasma is gradually organized, and thus becomes the nidus of the new bone by which the breach in the bodies of the vertebræ is finally closed up, the development of the osseous tissue taking place, in strict conformity with the laws of ossification in the fœtus. The new substance is extended like a bridge, across the spinal canal, and does not, therefore, encroach at all upon its contents; it is more solid than natural bone, and is usually several shades whiter. It connects together not only the contiguous bodies of the vertebræ, but also the remnants of the arches and spinous processes, soldering them into one solid, immovable mass (fig. 163). The heads of the adjoining ribs generally experience a similar fate. It will thus be seen that the cure of this disease is by ankylosis.

*Treatment.*—Caries of the vertebræ being merely, as already stated, a local manifestation of a general strumous vice, its treatment necessarily resolves itself into topical and constitutional, the latter holding the chief rank. I include, of course, among the constitutional means rest in the recumbent posture, as one of the most important elements of success in the management of every case of this kind, as an absolute, indispensable condition, not to be violated or departed from on any consideration whatever. If any one feels inclined to doubt the value of this precept, it will only be necessary for him to look around and

Fig. 163.



Remarkable example of angular curvature and ankylosis, with spontaneous cure.



behold the many hump-backed persons that everywhere meet his eye, to be satisfied of his error. Every object of this kind is a standing, living monument of the miserable treatment that is so generally pursued by the practitioners of this country. The very nature of the case suggests the propriety of absolute rest and recumbency. One need only observe the havoc committed by the disease to be convinced how utterly impossible it is for the weakened and crippled spine to support the superincumbent head and shoulders; it must inevitably yield under the heavy weight, and the distortion thence resulting must necessarily be in direct proportion to the amount of pressure thus maintained, and the extent of the gap left by the destruction of the bodies of the vertebræ. The reason why the curvature is posterior, is because the spinous processes, preserving their integrity, tend to drag the affected parts in that direction. Now all this may be effectually obviated by the observance simply of the recumbent posture, maintained faithfully and steadily, not for a few weeks or months, but, if necessary, for more than a year; in short, until nature has succeeded in bridging over the gap with new bone, capable of supporting the superincumbent weight. Until this is accomplished, the patient must on no account be permitted to rise off his couch for any purpose whatever. When this period has arrived, the surgeon will generally be made aware of it by the solidity and firmness of the affected parts, and the indurated and enlarged condition of the structures immediately around the seat of curvature, as well as by the subsidence of the more important functional symptoms.

It is a mistaken notion to suppose that a person laboring under caries of the spine will not brook confinement, or that it will tend to impair the general health. Those who have the largest experience in this matter know better. A child may be taught obedience to anything, especially when it is designed to relieve pain and suffering; he may resist at first, but a few days are generally sufficient to break him in, and to make him docile and contented, if not perfectly happy. It is not necessary that he should lie all the time in one posture; the prone position is undoubtedly the best, as it relieves the parts of congestion and pressure, but he may lie on his back, side, or belly, as he may find it most agreeable, and generally he manages this matter of his own accord, without any prompting from any one. No pillow should be placed under the head, as it is important that the occiput should be on a line with the spine, in order that no pressure whatever should be made upon the affected parts. The bed may be a common trundle one, with a good hair, moss, or cotton mattress.

I consider rest and recumbency, then, as of paramount importance in every case of caries of the spine; and the earlier they are employed the less danger will there be of ultimate deformity. It is the very first injunction that should be delivered by the surgeon when he prescribes for such a disease.

The constitutional remedies, properly so called, must depend upon circumstances. In general, the patient will be benefited by a course of chalybeate tonics, cod-liver oil, and a light, but nutritious diet, with an occasional dose of blue mass. If fever be present, or if there be

marked disorder of the bowels and secretions, an active purgative may sometimes be required; but, in general, it will be most judicious to avoid the employment of all kinds of depressants. The pain may be such as to demand, now and then, an anodyne, especially if it be so great as to interfere with sleep. Night-sweats are best relieved by quinine and aromatic sulphuric acid, and ablutions with tepid alum water, assisted by dry frictions and exposure of the body to the fresh air. Milk punch, ale, porter, and wine may be used if there be much debility.

The principal local remedy is an issue made with the actual cautery, which is incomparably superior, so far as my experience enables me to judge, to all other modes of counter-irritation of which I have any knowledge. It should be placed either on one side of the affected part, or immediately below or above, as may be deemed most convenient, and should be at least as large, when the eschar has dropped off, as half a dollar. Such a sore will not only yield an abundant discharge of pus, easily maintained for several months, but afford an excellent surface for the endermic application of morphia, if this should be considered necessary, on account of the severity of the pain. The ordinary pea issue is of no use in such a case, while that made with Vienna paste is altogether inferior to one made with the hot iron; for this instrument, besides destroying the integument, makes a powerful impression both upon the part and system, which is not the case with any other material. As to the seton, Mr. Pott long ago stigmatized it, in speaking of it in connection with this disease, as "painful and nasty," and I am sure that every sensible surgeon will concur with him in opinion. If the discharge from the issue flag, it must be promoted by the application of stimulating unguents, a small blister for a few hours, or a little Vienna paste. A second application of the cautery is seldom necessary in any case.

When there is reason to suppose that the parts have been sufficiently repaired to enable them to sustain the weight of the head, the patient may be permitted to rise, not, however, without having been previously provided with a suitable supporter. Such an instrument, to answer fully the object which it is intended to subserve, should combine lightness with strength, and should be constructed in such a manner as to come well up under the arms, at the same time that it makes gentle yet efficient pressure against the weakened spine, in the greater portion of its length. A hollow pad may be adapted to the angular projection behind.

No mechanical support should be used during the progress of the ulcerative action, except when it involves the cervical region, in which case some application of the kind is imperatively demanded, lest, in an unguarded moment, the affected pieces should suddenly cave in, and thus fatally crush the cord.

## PSOAS ABSCESS.

In consequence of disease of the vertebræ, pus not unfrequently forms at the anterior and lateral aspect of the spine, which, as it accu-

mulates, gradually descends towards the lower part of the trunk, where it ultimately points and is discharged, the event being preceded by the appearance of a fluctuating swelling. When the fluid passes down in front of the psoas muscle, the disease takes the name of psoas abscess, whereas, when it proceeds backwards towards the loins, it is called lumbar abscess; a distinction which, although topographically correct, must not be regarded as implying any difference in the nature of the two affections, inasmuch as observation has proved them to be perfectly identical in character.

*Pathology.*—An abscess of the kind now under consideration is essentially a strumous disease, which, according to my observation, can occur only in persons of a strumous predisposition. Hence it is often associated with tubercular disease in other parts of the body, especially of the lymphatic ganglions, lungs, and mucous follicles of the large bowel. The disease is rarely met with before the age of puberty, being most common between that period and thirty-five. I have never seen it in very young or in very old subjects. Both sexes are liable to it, but males suffer more frequently than females, but in what ratio is not known. It generally comes on without any assignable cause, although the patient is very apt to attribute it to the effects of cold, sprains, blows, or sudden twists of the body. Its march is always essentially chronic.

*Structure.*—Dissection shows that these abscesses always take their rise in strumous disease of the bodies of the vertebræ, commencing either upon their outer surface or in their cancellated structure. Occasionally there is reason to believe that it begins in the intervening fibro-cartilages, if not also in the neighboring periosteum. I have never seen an instance whose origin was not fairly traceable to spinal disease. The affection is sometimes double, an abscess occurring on each side, either simultaneously or within a short time of each other. The contents of a psoas abscess are of a tubercular character, precisely like those of a chronic abscess in the soft parts or of a strumous joint. They are usually intermixed with flakes of lymph, and cases occur in which they contain small particles of bone, or of bone and fibro-cartilage. The fluid, which varies in quantity from a few ounces to several quarts, is always inclosed by a distinct cyst, rough or villous internally, and firmly connected to the neighboring structures; it is of a dense, fibrous texture, and ranges in thickness from the fourth of a line to the sixth of an inch. In cases of long standing its length sometimes reaches an extent of from eighteen inches to two feet; occasionally it forms one continuous pouch, but more frequently it exhibits a sinuous arrangement, branches being sent off laterally. The psoas and iliac muscles are always atrophied, inflamed, discolored, and partially degenerated into fatty matter.

*Progress and Symptoms.*—As the disease progresses, the matter manifests a tendency to point, but without any uniformity in regard to the precise spot, although this is generally just above Poupart's ligament, external to the iliac vessels. Sometimes the matter gravitates down in front of the thigh, beneath Poupart's ligament; and I have observed cases where it showed itself on the outside of the limb, upon the nates



as low down as the tuberosity of the ischium, in the iliac region above the anterior superior spinous process of the ilium, and in the interior of the pelvis, its contents being finally evacuated into the bowel or bladder. Pointing in the lumbar region is by no means uncommon. In a few instances the matter has been known to pass out of the thyroid foramen, forming a tumor at the upper and inner part of the thigh. The period between the commencement of the disease and the occurrence of ulceration varies, on an average, from four to six months. Spinal abscess, for so this affection should be called, always begins in a stealthy and insidious manner, the patient being entirely unconscious for a long time that he is the subject of so serious a disease; he feels, perhaps, somewhat unwell, and finds that he is gradually growing weak and losing flesh and appetite; his face looks pallid, his sleep is irregular, and he occasionally has slight attacks of fever, followed by perspiration. At a still later period, exercise becomes exceedingly irksome, and he now begins to limp, especially after walking; he now also finds it difficult to extend his trunk and thigh, so that when he is up or going about, he is obliged to lean forwards a little towards the affected side, in order to relieve the parts of tension. A good deal of soreness is usually complained of in the back and iliac regions, extending along the front of the thigh; but anything like severe pain is seldom felt. After some time, varying from three to six months, a tumor becomes perceptible, soft, compressible, and fluctuating distinctly under the finger. When seated in the groin, or in the upper part of the thigh, it generally receives a marked impulse on coughing, and recedes more or less on recumbency, especially when conjoined with considerable elevation of the pelvis. In the lumbar and gluteal regions, on the contrary, coughing and position usually make no impression upon it. When the abscess points in the groin, a superficial observer might mistake it for an inguinal hernia; but the history of the case, the distinctness of the fluctuation, and the situation of the swelling, which is usually much nearer to the spine of the ilium than in rupture, will always afford just grounds for a correct diagnosis. When the tumor appears at the upper and inner part of the thigh, the only disease with which it is liable to be confounded, in its early stages, is femoral hernia.

The march of psoas abscess is usually steadily onward; so long as the sac retains its integrity the general health is often comparatively little affected, but as soon as it is opened, whether spontaneously or artificially, and the air is permitted to mingle with its contents, the constitution manifests at once the most lively sympathy, as is evinced by the rapid supervention of rigors and hectic fever, with all its train of evils.

*Prognosis.*—The prognosis of this disease is generally unfavorable, most patients perishing from its effects in from twelve to eighteen months. Very few, if any, ever make a good, permanent recovery. In most cases death occurs from hectic irritation, profuse sweats, and colliquative diarrhoea, either as the direct result of the abscess, or of the abscess and of lesion of other organs, especially of the lungs and bowels.

*Treatment.*—The treatment of spinal abscess is eminently unsatisfactory. Generally several months elapse before the true nature of the disease is ascertained, and when, at length, it is discovered, its ravages will usually be found to be of such a character as to render all efforts at a cure utterly hopeless. If a free, dependent outlet could be formed for the matter early in the disease, the probability is that the patient might occasionally get well; but when it is considered how much the osseous and other structures suffer before the fluid reaches the surface, it is not surprising that these cases should so uniformly prove fatal. Moreover, it is not to be forgotten that the abscess is merely a symptom of a general tubercular dyscrasia, which is, in itself, an unfavorable omen, as it is always likely to be followed by serious disease in other, and, perhaps, still more important organs. If the affection be left to itself, it will be sure to destroy life, and the event will hardly be any the less certain if it be surgically interfered with. Subcutaneous evacuation of the matter, as proposed by Abernethy, is not of the slightest use as a curative agent; in all the cases, and they have been a good many, in which I have tried it, no benefit whatever resulted, except that it occasionally afforded temporary relief from pain. The operation is always, in a very short time, followed by hectic fever, and by more or less rapid failure of the health and strength, no matter how carefully it may have been performed. Very frequently not even palliation is derived from it. Sorbefacient applications, in the form of lotions, unguents, or plasters, are of no particular use. When the sac has been opened spontaneously, advantage may sometimes accrue from the injection, twice a day, of tepid water, followed by some slightly astringent and anodyne fluid, or a very weak solution of iodine; but too much caution cannot be observed in the employment of this and similar measures, lest violent local and constitutional irritation be excited, thereby hurrying off the patient. Alterants may do good by improving the general health, but not as curative measures. In the latter stages of the disease, tonics and a nutritious diet will be necessary, with aromatic sulphuric acid to allay perspiration, and anodynes to procure sleep and arrest diarrhœa.

#### HYDRORACHITIS.

Hydrorachitis is a congenital defect, consisting in a cleft of the vertebral column, with a protrusion of the lining membranes of the spinal cord. The lesion, which is caused by an arrest of ossification, and consequent deficiency of the vertebral rings, is generally situated in the lumbar region, but occasionally it affects the dorsal, cervical, or even the sacral. It is frequently associated with hydrocephalus, and is analogous to those malformations which originate from a want of union of the two halves of the fœtus during utero-gestation, such as hare-lip, cleft-palate, and umbilical hernia.

The adjoining drawing (fig. 164), from a clinical case, a boy, six weeks old, shows a rare form of this disease. The tumor, which was seven inches and a half in circumference, was quite soft and fluctuating,

and tender on pressure, though free from inflammation. The child's health was excellent.

The malformations of the spinal column accompanying this affection may be arranged under the following heads: 1, division of the entire vertebra, even of its body; 2, partial or complete absence of the lateral arches; 3, perfect development of the lateral arches with want of union at the median line.

The protrusion of the spinal envelopes generally takes place during the latter months of foetal life; occasionally, however, it is not observed until some weeks or months after birth. When the tumor first shows itself, it may not be larger than a pea; but, as the disorder progresses, it gradually increases in size, varying in proportion to the deficiency of the vertebræ. Although the swelling usually does not exceed the size of an orange, yet occasionally it reaches that of the fist, and even of the patient's head. The skin is commonly very smooth, delicate, and thin; sometimes, however, it retains its normal thickness, or it becomes red, rugose, and horny; in a few rare cases, it is entirely wanting. The tumor is either soft, flabby, and fluctuating, or it is full, hard, and shining; when pressed upon, it gradually diminishes in volume, or completely recedes; but no sooner is the force removed than the fluid re-accumulates, and the part regains its previous bulk. In its form, the swelling is globular, ovoidal, or pear-like, with a short, narrow neck, by which it reposes upon the cleft bone. Fig. 165, from a preparation in my possession, exhibits a tumor of this kind in the lumbar region; it was about the size of a common orange, and was taken from a child five months old. Its cavity, which is here laid open, had been exposed by ulceration.

The *fluid* in hydrorachitis is generally of a thin, limpid character, slightly saline in its taste, and almost uncoagulable. In some instances, it is of the color and consistence of synovia, or it contains flakes of lymph and particles of pus. These appearances, however, are seldom present until after the swelling has burst, and discharged its original

Fig. 164.

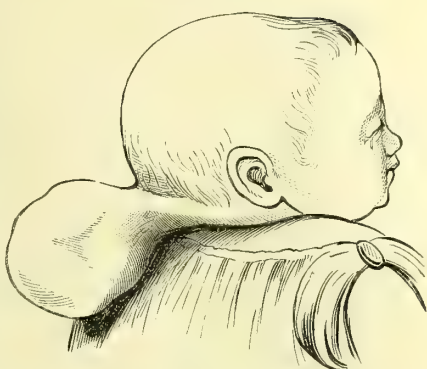
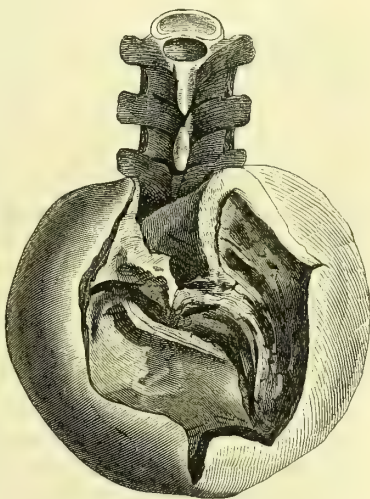


Fig. 165.

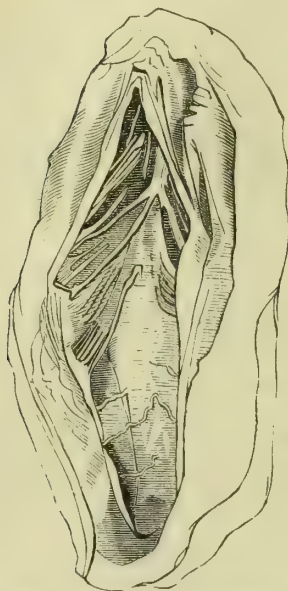


Bifid spine, the sac being laid open.



contents. The tumor usually consists of a single cyst; but there may be several, as in the multilocular variety of ovarian dropsy. In such a case it would be difficult, if not impossible, to draw off all the fluid by operation.

Fig. 166.



Bifid spine, showing the distribution of the nerves.

The contents of the vertebral canal in the immediate neighborhood of the lesion are variously affected. The portion of the spinal cord surrounded by the tumor is often very much softened, or converted into a thin, diffuent substance; sometimes it has been found abnormally hard; sometimes it is not so large as natural; and sometimes, again, it deviates remarkably from its accustomed route, being forced through the opening in the vertebræ, and partially contained in the swelling. The nerves are always more or less displaced; sometimes they are dragged out of the canal, and distributed over the inner surface of the cyst in a beautiful plexiform manner, not unlike that of the fleshy columns of the heart, as exhibited in fig. 166, from a preparation in my collection.

Hydrorachitis is one of the most *fatal* of diseases. Few children survive their birth longer than five or six months, while many perish in a much shorter time, death being caused either by convulsions, or by ulceration of the sac, and the sudden escape of its contents. It is true, life has sometimes been sustained until the age of puberty, and, in one case, until the fifty-fifth year; but such instances, although encouraging in a practical point of view, are altogether of an exceptional character, and cannot, therefore, be used for the establishment of any general law. If the tumor be ruptured during parturition, the infant is nearly always still-born, and if it be opened after birth, either accidentally or designedly, death usually follows in a few hours, the immediate cause of dissolution being convulsions from the pressure being taken off the brain in consequence of the loss of the cephalo-spinal liquid. The case is always likely to have a speedily fatal termination when it is associated with hydrocephalus, paralysis of the inferior extremities, or involuntary discharge of the urine and feces. Moreover, it may generally be regarded as being of a more hopeless character when it affects the cervical region than when it is seated in the dorsal, lumbar, or sacral.

The *treatment* of bifid spine is anything but satisfactory; for modern science, while it has been so suggestive of improvement in almost every other branch of surgery, has made no additions, even of a plausible nature, to what was known respecting the management of this malformation a quarter of a century ago. When the tumor is small, or of moderate size, a cure may occasionally be effected by

keeping up constant pressure with collodion, and a common roller, or a cup-shaped truss, lined with a thin air-cushion, so as to diffuse the pressure equally over the entire swelling. The compression should be aided by the occasional evacuation of the contents of the sac by subcutaneous puncture with a very fine trocar or bistoury, the opening being well closed immediately afterwards to prevent the introduction of the air. Only a portion, however, of the fluid should be drawn off at a time; if the whole be removed at once, convulsions will be inevitable, and from such an attack the child may perish in a few hours, the brain being unable to bear the sudden loss of pressure caused by the escape of the cephalo-spinal liquid. Sir Astley Cooper, early in life, treated successfully a case of cleft spine with simple compression alone; and, in another instance, soon afterwards, he was equally fortunate by combining this method with repeated punctures, as had been previously proposed by Mr. Abernethy. Subsequently, he employed the same measures in two other cases, one of which proved fatal, very unexpectedly, at the end of forty days, everything having before been in a promising condition, while the other recovered, at the expiration of a year and a half, after the tumor had been punctured thirty times, and the child had been given over as lost. Favorable results have also followed this plan of treatment in the hands of other practitioners, both in this country and in Europe, and is, I am satisfied, the only safe one of which we have at present any knowledge. The smaller, of course, the tumor is, the more likely it will be to succeed; if it be of inordinate size, or even if it be comparatively diminutive with a broad base, and a large cleft in the vertebræ, no treatment of any kind can be expected to be of any but the most transient benefit, and then only in the way of support with a view to the prevention of ulceration and the accidental rupture of the sac.

Benjamin Bell and other surgeons have suggested tying the base of the sac with a ligature, with a view of removing the tumor, and preventing further propulsion of the spinal membranes; but the results that have been published in favor of the operation are such as not to warrant a repetition of it. I have myself the particulars of several cases of this kind that have come either under my own immediate observation, or that have been communicated to me by other practitioners, and in every one the effects have been most lamentable, the patient dying either immediately after the operation from convulsions, or a short time afterwards from an extension of the inflammation to the spinal cord and its envelops. The same may be said of the operation of excision after ligation of the pedicle, and the application of the actual or potential cautery for the purpose of exciting adhesion between the opposing surfaces of the sac. All such procedures cannot be too pointedly condemned, as being both unscientific, and certain to prove fatal. The only case in which ligation can ever be proper is where the sac has an uncommonly narrow pedicle, with an exceedingly small aperture of communication, but even under such circumstances, which are extremely infrequent, the safer practice unques-

tionably would be systematic compression in union with occasional puncture.

Dubois, with the hope of gradually diminishing the size of the tumor, and of ultimately agglutinating the serous surfaces at its base, proposed the application of pressure, at this particular point, by means of two narrow steel plates, regulated by two screws, and prevented from slipping by passing two stout needles immediately in front of them, across the swelling. He succeeded, in this manner, it is alleged, in curing his patient. I am not aware, however, that it has succeeded in the hands of other surgeons, and I can discover no material difference, either in point of principle or practice, between it and compression with the ligature.

Finally, it has been proposed to cure hydrorachitis with *injections* of iodine; the operation, however, has been performed only a few times, and nearly always with a promptly fatal result. The great objection to such a procedure is that it is impossible to circumscribe the resulting inflammation sufficiently to prevent it from spreading to the spinal cord and its envelops.



## CHAPTER IV.

## DISEASES AND INJURIES OF THE EYE.

WRITERS upon ophthalmic medicine and surgery have almost an incredible catalogue of diseases and injuries of the eye, from the little louse that nestles at the root of the lashes to carcinoma, terminating in destruction of all the component tissues of the organ. Not content with describing what is peculiar to these structures, they give the most minute and tedious account of every lesion that can possibly occur in any other region of the body, thus needlessly confusing, perplexing, and bothering the pupil, if not disgusting him with the study of a class of affections which, if properly discussed, could not fail to be of the deepest interest to him. Such a course is, to say the least, highly objectionable, if not positively unscientific, and well calculated to retard the progress of ophthalmic investigations. The barbarous nomenclature introduced by our German brethren, and which savors too much of charlatanry to be retained in our literature, has tended, perhaps, more than anything else, to inspire professional men with a dislike, if not positive aversion, to the study of the maladies of the eye, and has, doubtless, been one of the principal reasons why this class of affections is so often, both in this country and in Europe, in the hands of empirics. Why cannot writers on the diseases of the eye content themselves with a proper simplicity and with what legitimately belongs to this department of medicine and surgery? There is no more necessity for the ponderous tomes of some of the French, German, and English ophthalmologists than there is for the overgrown folios of some of the ancient writers on medicine. What is truly useful in this department of pathology and practice may be comprised in a comparatively small compass, and should certainly be divested as much as possible of the jargon of the pedant. Stripped of their meretricious character, works on the eye would be read with the deepest interest, and the consequence would be that the diseases of this organ would be understood a hundred-fold better than they now are, or than they are likely to be so long as this objectionable course is continued. Why should we designate an adhesion of the iris to the lens as *synechia*, a protrusion of the iris across the cornea as *myocephalon*, a cohesion of the lids as *ancyblepharon*, and an operation for closing a lachrymal fistule as *dacryocystosyringokatakleisis*? Really, this is quackery in its worst guise. Is not the word *crablouse* quite as euphonious as *phtheiriasis*?

## SEC. I.—MODE OF EXAMINING THE EYE.

*Ophthalmoscope.*—The most important discovery of the present century, as an auxiliary to the study of the diseases of the eye, is that of the ophthalmoscope, a contrivance by whose aid the dark background of this organ may be lighted up, and its delicate tissues clearly inspected. Of the many instruments of the kind now in use, that devised by Dr. Anagnostakis, of Athens, is perhaps the most simple and valuable, combining, as it does, great facility of application with portability and cheapness. At all events, it is, with some unimportant modifications, the one now most generally employed. It essentially consists of a lens and of a concave, circular mirror, about two inches in diameter, perforated in the centre by a small hole, to the back of which is fitted a plate of blackened copper, the whole being inclosed in a brass ring and mounted upon a short handle.

During the examination, which must always be made in a dark room, the mirror is held in one hand, and the lens close before the eye in the other. Unless this precaution be adopted, it will be impossible, in the great majority of cases, although the bottom of the organ may be highly illuminated, to obtain a distinct view of any of its individual parts. The lens may be bi-convex or bi-concave, with a focus of from one and a half to two inches, the former affording an inverted, and the latter an erect image. The inspection with the bi-convex instrument is generally to be preferred, as it is more easy, less trying to the eyes of the surgeon and the patient, and more satisfactory in regard to the range of the retina. In either case, the pupil must previously be dilated with atropia, in the proportion of one-twentieth of a grain to the ounce of water, a small quantity of which is applied several times to the eye a few hours before.

The observer and patient should sit facing each other close by the side of a table on which stands a bright lamp as nearly as possible to the patient's side, only a little behind him, and on the same level with his eyes. The speculum, held in the right hand, is so placed that the light of the lamp is reflected by its polished surface upon the organ to be examined. The observer then applies his eye close to the hole, and approaches or recedes from the patient's face, keeping the flame all the while steadily upon the eye, until he sees the pupil appear of a bright red color. The double convex lens, held between the thumb and index finger of the left hand, is then placed close to the organ, when, by slowly moving the mirror back and forth, he can soon find the proper focal distance, and readily see a distinct bloodvessel, as well as other objects, at the bottom of the eye. This distance should be as firmly maintained as possible, and the vessel followed to its entrance into the optic papilla. This is done either by moving the mirror slowly from side to side, or, what is better, by displacing the lens slightly in the same way, keeping in mind that the objects at the bottom of the eye move in the opposite direction from the lens. The optic papilla should be the first object sought and inspected; afterwards the observer may examine the adjacent parts of the retina and choroid as far forwards

even as the ora serrata. The papilla is seen as a brilliant, well-defined, yellowish-white spot, usually circular in form, and contrasting strongly with the neighboring parts of the retina, which appear of a light pinkish-red color. Either in the middle of this spot, or a little to one side, are seen the central artery and vein of the retina, each having two branches, one ascending and the other descending, while several smaller ones extend outwardly. By looking steadily at these vessels while slight pressure is made with the finger on the ball, they may be seen to move distinctly and synchronously with the pulse at the wrist.

The optic *papilla* may be variously changed by disease; but the most important alteration which it experiences is an umbilical depression with perceptible pulsations of its vessels sometimes seen in glaucoma. The phenomenon, however, which is probably due to intra-ocular pressure, is usually not detected in this affection until a late period. It is occasionally conjoined with textural changes in the adjoining portion of the retina, and when this is the case the papilla is liable to lose its distinctive appearance, becoming insensibly lost in the surrounding parts. In inflammation of the retina, both this membrane and the optic papilla are preternaturally vascular, and not unfrequently the seat of plastic deposits, superficial as well as interstitial, ecchymoses, and other alterations. Sometimes the retina is partially detached from the choroid by dropsical accumulations, presenting themselves in the form of bluish-white, undulating bags, projecting forwards into the vitreous humor.

Inflammation of the *choroid*, with exudation and subsequent thinning of that membrane, and absorption of its pigment, as in the disease called posterior sclerotico-choroiditis, is characterized by the appearance of brilliant white, irregular spots, produced by the strong reflection from the sclerotica. A number of cases have recently been described in which the cellular cysticerce, a peculiar form of entozoon, was found in the retina, between this membrane and the choroid, and in the vitreous humor.

The most common pathological changes in the *vitreous humor* are liquefaction of its substance with diffused turbidness, and brownish shreds, or corpuscles, of various shapes and sizes floating in it, mounting up into the pupil when the eye is moved, and subsiding to the bottom of the organ when it is held still. These are either masses of lymph that have been detached from the retina, choroid, or ciliary body, the remains of blood that has been poured out into the eye, or, perhaps, portions of the disorganized hyaloid membrane. These changes of the vitreous body are nearly always attended with serious diseases of the retina, but it is often impossible to distinguish this membrane through the opaque substance. Such floating bodies are very readily detected by the ophthalmoscope without the use of the lens.

The speculum is a useful means also for determining the degree of saturation of the crystalline lens in cataract and the different varieties of that disease. Incipient and slight opacities of that organ, which had entirely eluded the most careful examination with the unassisted eye, have sometimes been easily detected with this instrument. They appear



as a brownish, grayish, or drab-colored veil, or as streaks across the red background of the eye. No lens is necessary in examining the crystalline body; and a weak light is preferable to a strong illumination. Its opacities are more readily detected by looking obliquely into the pupil, when they usually appear of a grayish color.

These are but a few of the pathological changes in the back part of the eye, which have already been brought to light by the ophthalmoscope. They are, however, sufficient to establish its indispensable importance in the discrimination of those numerous diseases which were formerly all grouped together under the general name of amaurosis. It need hardly be added that it requires much patience and practice with the instrument to give one that tact in the use of it so necessary to precision of diagnosis.

*Ocular Inspection.*—In examining this organ with the unassisted eye, with a view of ascertaining its condition, the patient should sit upon a chair, in a good light, unless there is severe inflammation, in which event he must sit with his back towards it. The upper lid may be gently elevated by means of the index finger, the point of which is placed against its free border, or with an instrument specially constructed for the purpose, as one of those here represented (figs. 167,

Fig. 167.

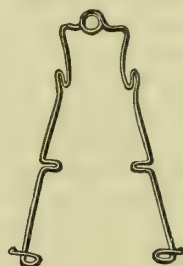


Fig. 168.



Elevator of Pellier.

Fig. 169.

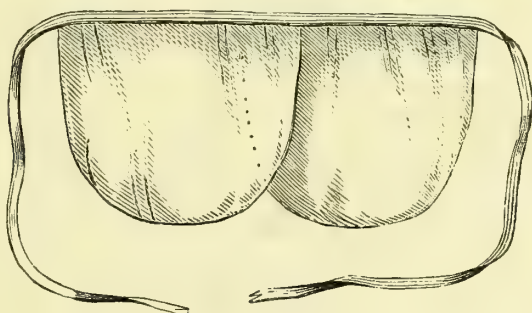


168, and 169). The lower lid is easily depressed with the finger applied to the margin of the orbit, and drawing down the skin; a procedure which, at the same time, freely exposes its inner surface. Eversion of the upper lid is effected by means of a probe, director, or pencil, placed horizontally along the upper margin of the tarsal cartilage, and gently pressed against the surface, while the surgeon, standing behind or in front of the patient, raises the free margin of the lid by the cilia, with the thumb and forefinger.

When the object is to examine the interior of the eye, for the purpose of ascertaining the condition of the crystalline lens, vitreous humor, retina, or choroid, the pupil should be previously dilated with a solution of atropia, in the proportion of about half a grain to half an ounce of water. Of this, a few drops may be applied to the ball every thirty minutes, until the object is attained; or, instead of this, a cloth wet with a strong solution may be kept upon the eyelids and eyebrow for several hours. The extract of belladonna, formerly so much employed for dilating the pupil, is now seldom used.

In all cases of inflammation of the eye, and after all important operations upon this organ, the light should be carefully excluded from the patient's apartment, as the smallest quantity, falling upon the retina, generally proves hurtful. Sometimes the light requires to be merely moderated, and when this is the case, the object may be attained by the use of a green shade of a semilunar shape, made of a piece of thin pasteboard, covered with silk, and secured to the head by means of tapes tied at the occiput. After operations on the eye, especially those for cataract and artificial pupil, the organ must always be completely screened from the light, either by a thin handkerchief, or a particular bandage, constructed after the fashion represented by the annexed drawing (fig. 170), and fastened by several turns of a roller. Some-

Fig. 170.



Bandage for the eyes after operations.

times we are obliged to close the lids carefully with adhesive strips, especially after wounds of the cornea.

#### DISPLACEMENT OF THE BALL OF THE EYE.

Displacement of the globe of the eye, technically called *exophthalmos*, may be produced by various causes, of which the most common are different morbid growths in and around the orbit. A mass of fat or an *exostosis*, by filling up the bottom of this cavity, may thrust the eye forwards, out of its natural position, and even force it out upon the cheek, completely beyond the lids. Similar effects are sometimes caused by polyps of the nose, and by fibrous tumors of the maxillary sinus. When the displacement is very great, so that the optic nerve is put much upon the stretch, as well as compressed, dimness of sight, if not total blindness, is apt to ensue. When the dislocation is the result of an accumulation of fat in the orbit, it may affect both organs simultaneously, as in the following case, which fell under my observation in 1848:—

Powtan, a black boy, 12 years old, tall and slender, has had a remarkable protrusion of both eyes ever since he was two years old. At present, the balls hang, as it were, from their orbits, projecting nearly half an inch beyond the level of the nose, which, however, is rather flat. They preserve their natural direction, but cannot be moved about, and they do not appear to be at all enlarged or hypertrophied. The

sight is unimpaired. The upper lids are remarkably full towards the eyebrows, and are one inch and a half in the vertical direction, by two inches and a quarter in the transverse. Notwithstanding this inordinate development, they are insufficient to cover the ball of the eye completely. The lower lid is about the natural size. The right cornea, at its inferior part, has an opaque spot upon it, and the pupil has the appearance of having been injured, being vertically elongated. The orbits do not seem to contain any hard substance or tumor, as the finger may be pushed into them some distance between the brow and upper part of the ball. The boy has occasionally had neuralgic pains in the eyes, with lachrymation, but in other respects he has been free from suffering. His general health is good. The protrusion has been stationary for some time past.

By a singular coincidence, this boy died, while under my care, of gastritis, thus affording me an opportunity of seeing his eyes by dissection. Upon removing the eyes, or, rather, the contents of the orbits, I found the cause of the protrusion to be an accumulation of fat behind each ball, and within the muscles; it was of a yellowish color, and rather more firm than common. The ball rested upon it as in a cup. The optic nerves were normal, but apparently somewhat longer than usual. The straight muscles of the right eye were larger than those of the left. The lachrymal glands were forced considerably forwards, but were of the natural size, color, and structure. The inner wall of the orbit, especially the left, was more prominent than common, but had no agency in producing the protrusion. Both eyes were perfectly sound.

A partial displacement of the eye is sometimes caused, at least apparently, by an elongated and relaxed state of the straight muscles; the affection, which always imparts a disagreeable expression to the features, is most common in weak, hysterical females, and demands a tonic, invigorating course of treatment.

The eye is occasionally dislocated from its socket by external violence. I have never met with such a case in the human subject, but some years ago I saw one in a little poodle, which, in a fight with a large mastiff, only half an hour previously, had the misfortune to suffer from this accident. The eye hung completely out upon the cheek merely by the optic nerve, without any injury to the ball, but with great stretching of the different muscles, two of which were torn nearly entirely across. The displacement had evidently been produced by the canine tooth of the mastiff. Without any difficulty I replaced the eye into its socket, and had the satisfaction to find my patient make a rapid recovery, without the slightest apparent impairment of vision. Although I had expected, in this instance, merely to visit the lady, and not her poodle, I never shall forget the interest which the case afforded me, and with what pleasure I watched its progress.

#### DISEASES OF THE CONJUNCTIVA.

The conjunctiva is the seat of various forms of inflammation, known by the generic term ophthalmia, assigned to them long ago by writers



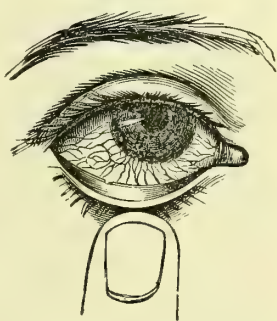
on the eye, and still generally recognized by authors. There is no class of diseases whose nomenclature has been more uselessly encumbered with unmeaning epithets than this. There is an array here of names well calculated to alarm any one, even the most courageous; the conjunctivitis are, in fact, almost endless. Thus, we have the simple, the catarrhal, the idiopathic and traumatic, the pustular, aphthous, purulent, gonorrhœal, granular, strumous, exanthematous, and ever so many besides. If writers can discover any reason for such divisions and subdivisions, it is more than I can, and I shall, therefore, respectfully decline to adopt them.

1. *Simple Inflammation*.—The most simple form of conjunctivitis, as well as the most common and most easily managed, is that which results from the suppression of the cutaneous perspiration, exposure of the eye to intense light, the lodgment of a foreign body, disorder of the digestive apparatus, or, in short, from any slight, common, and transient cause, whether operating directly upon the eye itself, or indirectly through the general system. The symptoms denotive of the morbid action are abnormal redness of the conjunctiva, pain, lachrymation, and intolerance of light, with a slight discharge of mucus, barely sufficient, perhaps, to glue the lids gently together in the morning, or after a few hours sleep. The vessels, as seen in the accompanying cut (fig. 171), are small, tortuous, and few in number. There is no tumefaction of the lids, no involvement of the cornea, iris, or sclerotica, and no purulent secretion. In a word, the inflammation is of the most simple nature, and, unless neglected or badly managed, generally disappears in from two to three days at farthest, the eye rapidly regaining its natural characters and functions.

An inflammation like this, however, may, in consequence of mismanagement or a continuance of the operation of the exciting cause, become a much more serious affair, and, in the end, be productive of extensive structural mischief. The discoloration will then be more diffused, the conjunctiva exhibiting a uniform scarlet or bloodshot appearance; and there will be excessive lachrymation, great increase of pain, severe intolerance of light, a muco-purulent discharge, more or less profuse and glutinous, and involvement of some of the other structures of the eye.

The *redness* of conjunctivitis is peculiar, not only in the milder and more common forms of the disease, but in every other. It is of a scarlet hue, and may occur either in circumscribed spots, or, as is more generally the case, be diffused over the whole anterior surface of the ball, except the cornea, according to the extent of the inflammation; very generally it affects also the inner surface of the lids, and it may even be greater there than elsewhere. It is seated exclusively in the conjunctiva and ocular fascia, or in the conjunctiva and the subjacent cellular tissue, and is usually most conspicuous where the membrane is

Fig. 171.



Simple conjunctivitis.

reflected from the lids over the sclerotica. The arrangement of the vessels is also peculiar. They are spread out arborescently, and are perfectly movable, tortuous, and remarkably distinct, hundreds being visible in every direction, where in the natural state there is hardly one. As the disease augments in intensity, the vessels are, as it were, lost, the inflamed surface exhibiting a uniform scarlet appearance.

There is a great difference between the *redness* of conjunctivitis and the discoloration of scleritis, and, as the subject is one of much practical importance, it cannot receive too much attention. In the former the color of the inflamed surface is scarlet, especially if the disease has made considerable progress; in the latter, on the contrary, it is pink, or lilac, the reddish hue contrasting beautifully with the naturally bluish tint of the fibrous structure; in the one it is superficial and movable, in the other deep and fixed. In conjunctivitis the vessels are large and ramiform, anastomosing with each other in every conceivable direction; in scleritis, they are very small, and disposed longitudinally, running from behind forwards in parallel lines towards the cornea, where they form a distinct zone, often extending completely around the eye. In violent conjunctivitis all trace of vessels is lost; in scleritis, on the contrary, they always remain distinct, however severe the attack. A little attention to this subject will soon familiarize the young surgeon with these characteristics, and enable him without difficulty to form a correct diagnosis between the two affections requiring such opposite modes of treatment.

The *pain* in conjunctivitis is seldom severe, except in the more violent forms, when it is often exquisite. In general, there is merely a sense of uneasiness, or a feeling as if there were a particle of foreign substance in the eye; an occurrence due to the distended state of the vessels. The uneasiness, pain, or aching, is steady, but liable to vesperal exacerbations and remissions, and confined mainly to the site of the disease. In scleritis it is severe, deep-seated, paroxysmal, and circumorbital, generally affecting the temple, cheek, and forehead.

The *lacrimation* is often considerable, even in the milder forms of conjunctivitis; the tears are hot and scalding, and often gush out in a full stream the moment the lids are separated. The flow may continue profusely for an indefinite period, but, in general, it lasts only a few days, when it sensibly diminishes, and soon after entirely disappears, especially if there be much muco-purulent secretion, a plentiful discharge of tears and matter seldom co-existing for any length of time.

The intolerance of *light* varies; sometimes it is quite insignificant, at other times excessive. In general, however, it is an important symptom, for there is hardly a case of ophthalmia where there is not more or less of it. In the strumous variety it is characteristic, and is often so excessive as to induce the sufferer to bury his face in the bedclothes, or, if he is a child, in his nurse's lap.

Much difference also obtains in regard to the *discharge* of mucus, pus, or muco-purulent matter. In the more simple cases there is usually only a slight increase of the natural secretion; but if the disease is at all severe the discharge will be abundant, thick, glutinous,

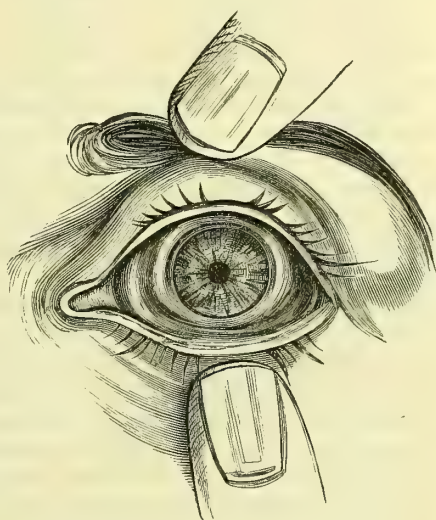
and of a decidedly muco-purulent nature. Indeed, there are certain varieties of ophthalmia which derive their distinctive features from the character of the secretion thrown off by the inflamed surface; as, for example, in purulent and gonorrhœal conjunctivitis. The Meibomian glands, participating in the inflammation, also furnish an abundant secretion, of a peculiarly viscid nature, which, mingling with that derived from the mucous membrane, causes the agglutination of the edges of the lids, so common and so annoying in the more severe forms of conjunctivitis. In scleritis and corneitis, the discharge of mucus is generally trifling, while a formation of pus is a comparatively rare occurrence.

*Tumefaction* of the conjunctiva is present only in some cases, and is dependent, not upon any marked distension of the membrane itself, but upon the infiltration of the subjacent cellular tissue, commonly known at the present day as the ocular fascia, a structure which, I believe, I was the first to describe, in 1839, and which plays so important a part in all the more violent forms of conjunctivitis. Possessed of great laxity, this texture admits of extraordinary distension with serum, or sero-plastic matter, giving rise to the state called *chemosis* (fig. 172), and which is so frequent a source of sloughing of the cornea. When the tumefaction exists in its worst degree, it forms a kind of rim around the cornea, often several lines in depth, causing the front of the ball to have a cup-shaped appearance. Much swelling is also frequently present at the inner canthus, and at the point of reflection of the conjunctiva from the lids over the sclerotica. It is worthy of note that this symptom is entirely absent in scleritis and corneitis, as well as in the more deep-seated inflammations of the eye.

Swelling of the lids is rarely present in simple conjunctivitis, or even in many of the more severe cases; in purulent and gonorrhœal ophthalmia, on the contrary, it forms a conspicuous and troublesome symptom, greatly increasing the local suffering, as well as materially interfering with the examination and medication of the eye. In this respect, again, conjunctivitis differs remarkably and characteristically from scleritis and corneitis, in which the lids are either not swollen at all, or only very slightly.

2. *Granular Inflammation*.—The lids are occasionally the seat of a villous condition of the conjunctiva, liable to degenerate into little

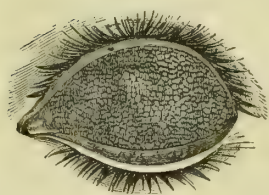
Fig. 172.



Chemosis, or swelling of the conjunctiva.



Fig. 173.



Granular lid.

bodies, which, from their resemblance to the structures observed upon a healing ulcer, are denominated granulations (fig. 173). These bodies, which are nothing but enlarged villi, found in such abundance upon nearly all mucous surfaces, are never present in ordinary conjunctivitis, while they are exceedingly common in certain varieties of that disease, especially such as are attended with purulent discharge, often forming in an almost incredibly short time. They are always most abundant upon the upper lid, where they are frequently extremely large and numerous, giving the mucous surface a rough, mammillated appearance, not unlike that of a strawberry; they are of a deep red color, and usually occur in groups, which are often separated by well-marked fissures. Similar bodies are generally met with on the lachrymal caruncle, though seldom in large numbers. On the lower lid they are always comparatively small, and more straggling than on the upper.

In the Southwest, where these granulations are extremely common, I have often seen them form in immense numbers, and of quite a large size, in less than forty-eight hours after the commencement of the inflammation which precedes and accompanies them. In some regions of that country, especially in the Wabash Valley of Indiana, and some parts of Illinois, Kentucky, and Mississippi, the disease is occasionally epidemic. Boatmen on the Ohio, Mississippi, and other rivers are remarkably prone to its attacks. During my residence at Louisville, I treated large numbers of cases of this kind, and other cities, as St. Louis, Memphis, New Orleans, and Chicago, have always had a full share of them. I have found the malady much more common in men than in women, and in young and middle aged subjects, than in children and old persons, and I have often thought that it was, at times, of a miasmatic origin, though I have no proof that this is really the fact. It is, nevertheless, true that it is much more frequent in those regions of the Southwest where neuralgia and intermittent fever are most prevalent. Persons who sleep out in the open air, or who travel much at night, are particularly liable to its attacks.

The disease is always attended with a profuse discharge of thick, viscid, yellowish pus, and with the other phenomena of the more violent forms of conjunctivitis. From the friction which the granulations constantly exert upon the ball, the cornea soon becomes involved in interstitial deposits, being often rendered thereby completely unfit for the purposes of vision. This peculiar state of the lids can be ascertained only by a careful examination of their inner surface, and I would, therefore, advise that they always be thoroughly everted whenever there is the slightest purulent discharge, leading to a suspicion of their existence. I have seen an immense number of cases where total blindness was produced by this disease, without the attending physician having ever inspected the condition of the lids, or known what the nature of the affection really was. Such neglect cannot be too strongly reprobated.

3. *Purulent Inflammation.*—The purulent ophthalmia of authors derives its characteristic features from the nature of the attendant discharge, which is generally excessively profuse, thick, viscid, and irritating; setting in within a few hours after the attack, and continuing steadily until the disease disappears. The affection, from being very common in Egypt, has received the name of Egyptian ophthalmia, although it occurs in all parts of the world, particularly in the warmer latitudes, where it is often epidemic. Sporadic cases are constantly met with everywhere. It is most common among the humbler classes, and seems to be caused by atmospheric vicissitudes. The matter which is so profusely secreted is contagious, being capable of communicating the disease by actual contact or inoculation. The inflammation is of the most vehement character, being accompanied with the most atrocious pain, swelling, discharge, and intolerance of light; the lids are enormously distended (fig. 174); the conjunctiva is profoundly chemosed; and the cornea, buried almost out of sight, becomes speedily opaque, and finally sloughs, vision being irretrievably destroyed. Of the frightful character of this distemper, when it prevails as an epidemic, some conception may be formed when it is stated that the Chelsea and Kilmainham hospitals contained at one time, soon after the return of the British troops from Egypt, 2317 soldiers who were totally blind from its effects. The case of the ship *Rodeur*, a French slaver, affords a good illustration of the manner in which the disease spreads under circumstances of the atmosphere favorable to its propagation. Of the blacks, 160 in number, among whom it first broke out fifteen days after their departure from the coast of Africa, thirty-nine of those who survived were totally blind, twelve lost each an eye, and fourteen had corneal opacity. Of the crew, consisting of twenty-five persons, only one escaped, and he was attacked soon after he landed at Guadaloupe. It is asserted that 30,000 cases of this disease occurred in the Prussian army, from 1813 to 1821; and the Belgian army, it would seem, has suffered still more extensively.

Purulent ophthalmia occasionally occurs in the *infant* within a few days after birth, in consequence, as has frequently been supposed, of inoculation with gonorrhœal or leucorrhœal matter derived from the mother at the time of birth. That such a thing is possible is unquestionable, for multiplied observation has fully established the fact; but that it is generally, or even frequently the cause of the disease, is certainly not true. Of all the cases that I have seen, and the number has been quite considerable, I have never been able to trace a solitary one to the effects of inoculation of any kind, notwithstanding the most

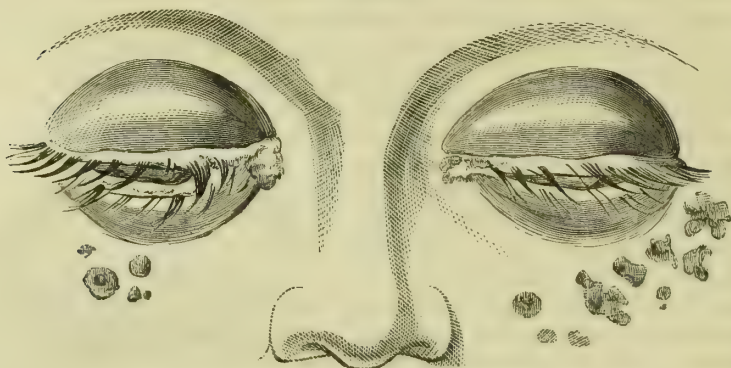
Fig. 174.



Purulent ophthalmia of recent date.

minute and circumstantial inquiry into their history. The mothers in all the cases were beyond the reach of suspicion, as it respected their chastity, and, as far as could be ascertained, perfectly truthful. My conviction is that the disease, as it usually appears, is of atmospheric origin, depending upon the same causes as the purulent ophthalmia of adults, and that it is, therefore, wholly free from specific poison, although, perhaps, capable of being communicated by inoculation. However this may be, it is characterized by an abundant discharge of a thick, yellowish pus, great redness of the conjunctiva, and so much swelling of the lids (fig. 175), as to render it extremely difficult, if not

Fig. 175.



Purulent ophthalmia in newly-born infants.

impossible, to separate them, so as to get anything like a fair view of the cornea, which is often early involved in the disease. The most healthy children, as well as the most puny, are subject to this disease, the former, according to my experience, suffering more frequently than the latter; it generally runs a rapid course, and, unless properly managed, often eventuates in total blindness, especially when, as usually happens, both eyes are affected.

4. *Gonorrhœal Ophthalmia*.—This disease is produced by the contact of gonorrhœal matter. It is a most virulent form of inflammation, spreading with great rapidity from the conjunctiva to the other structures of the eye, which is usually completely destroyed in a few days. Its principal phenomena are excessive discoloration, and swelling of the conjunctiva and of the lids, profuse muco-purulent discharge, of a yellowish and very viscid character, great pain, lachrymation, and intolerance of light, and early opacity of the cornea, which soon dies and sloughs, thus permitting the escape of the humors with the consequent collapse of the eye (fig. 176). Positive inoculation is necessary to the production of this disease; I have never seen an instance where it showed itself as a secondary affection, and I strongly question the possibility of such an occurrence, notwithstanding the many apparent proofs that have been adduced in its support. The disease usually begins in one eye, but in most cases the other becomes also involved from the accidental contact of the matter.



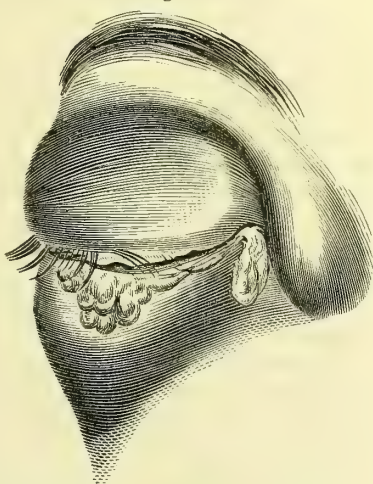
There is something very curious about this disease, which has not yet been satisfactorily elucidated. If gonorrhœal ophthalmia is really an entity, why is it that it does not occur more frequently, for there are thousands of persons, ignorant and filthy, who, while laboring under specific urethritis, constantly carry their fingers, besmeared with matter, to the eye, often rubbing and scratching it, and yet do not contract the disease? May we infer from this that it is difficult of propagation, or that it can only be produced in this way in some individuals and not in others? Authors constantly adduce cases in which this variety of ophthalmia is said to have been induced by

the contact of the patient's urine, employed for bathing the eye, under the popular belief that it is a good and speedy cure for the disease. Now, is this possible? Does not this admixture of the two fluids effectually destroy the specific poison of gonorrhœa? Could the matter of smallpox, chancre, and other diseases, withstand the neutralizing influence of so acrid and readily-decomposed a fluid as the urine? These questions afford food for reflection, and should, if possible, be settled before we receive as true all that has been written upon the subject. This is the more necessary, because it is well known that the ordinary, non-specific form of purulent ophthalmia often destroys the eye completely in less than three days after its outbreak. Meantime, the only evidence that the disease is of a gonorrhœal nature is derived from its history; that is, we cannot be certain that the affection of the eye is specific, unless we know that the patient is laboring under specific urethritis. Such a diagnosis is, to say the least, not very philosophical, for it may well be asked whether it is not possible for a non-specific but destructive inflammation of the eye to take place during the progress of an ordinary gonorrhœa, and yet be entirely independent of it? As for myself, I can readily conceive of such an occurrence, although, granting all that might be said respecting it, it would be very natural to view the two affections in the light of cause and effect.

As to strumous ophthalmia, the consideration of such a disease would evidently be misplaced among the conjunctivitis; it is an affection of the whole eye and of the constitution at large, and must, therefore, be brought in under another head.

*Treatment.*—In the treatment of conjunctivitis, even of the more severe varieties, the practitioner must constantly divest his mind of the idea of specifics; he must recollect that the affected structure is mucous in its character, and that the disease, except in its milder

Fig. 176.



State of the lids in gonorrhœal ophthalmia.

grades and forms, will speedily extend to the adjoining parts, involving them in mischief, if not in irreparable ruin. His attention must be particularly upon the alert when the inflammation is attended with muco-purulent discharge, great swelling of the lids, chemosis, and atrocious pains; for, under such circumstances, there is great danger of serious involvement of the other tunics of the eye, particularly of the cornea, the slightest opacity of which always awakens the most painful apprehensions on the part of the experienced surgeon for the safety of the affected organ. Any such appearance should put us upon our guard respecting the prognosis of the case, while it should induce us to redouble our efforts to arrest the morbid action. An examination of the eye should not be made oftener than is absolutely necessary to observe its condition, but such information should not be neglected on any account, although it may be obliged to be obtained at the expense of considerable suffering.

The milder forms of conjunctivitis generally yield to very simple treatment. Confinement in a dark room for a short time, light diet, an active purge, and tepid, cool, or cold bathing of the eye, with, perhaps, a Dover's powder at bedtime, constitute the most appropriate remedies. When the inflammation is more violent, or disposed to be somewhat obstinate, the list may be increased by the addition of the antimonial and saline mixture, with greater restriction of the diet, and the abstraction of blood from the neighborhood of the affected tissues by leeching or cupping. Depletion by the lancet can be required only when the patient is plethoric and the inflammation intense. Under such circumstances the surgeon never hesitates to take blood freely, drawing it from a large orifice in a bold and rapid stream, just as we do in any other inflammation threatening loss of structure and function. Judging from the remarks of some recent ophthalmic writers respecting general bleeding in diseases of the eye, one would suppose that they considered this organ as forming a sort of system by itself, not governed by the ordinary laws of the economy. I am certainly not inclined to carry the operation so far as some practitioners, who, according to their own reports, have occasionally reduced their patients to the very verge of the grave by it, draining them to almost complete anemia, or until the countenance was of a deadly, waxen, pallid appearance, and the poor sufferer could hardly raise his head off his pillow. Such a course is quite as censurable as the opposite. One good, thorough bleeding, at the commencement of the disease, while the patient is in the semi-erect posture, will often cut short an attack, which, without such a measure, might eventuate in the destruction of the eye, or, at all events, in great suffering and more or less impairment of sight. The same rules that are applicable to bleeding in other diseases are applicable to this. The robust countryman will bear the loss of blood much better than the man who lives in a crowded city, who is the inmate of an ill-ventilated hospital, or who has spent half his time in intemperance and dissipation. The extremes of life, the state of the system, and the nature of the attack, must all be taken into the account. When general bleeding is contra-indicated, blood may nearly

always be taken, with great advantage, by leeching and cupping, practised early and efficiently, but not indiscriminately and sakelessly.

Among the more important remedies in the different forms of conjunctivitis cathartics hold a prominent rank; unless there is some positive contra-indication, they should partake somewhat of the drastic character, so that they may produce both a derivative and purgative effect. They should be given early and late in the disease, with proper regard, of course, to the strength of the patient and the state of the intestinal mucous membrane. Among the more appropriate articles are senna and Epsom salts, jalap and cream of tartar, and the compound calomel pill. When decided evidence of gastric disorder exists, the use of the purgative may be preceded by the exhibition of an emetic. Vomiting, however, is only admissible so long as there is no tendency to disorganization of the eye; for when this is present, the concussion which it would cause could hardly fail to prove injurious. Nauseants must be used more or less freely in all stages of the inflammation; either in the form of the antimonial and saline mixture, or in that of a solution of tartar-emetic and morphia; the dose and the frequency of its repetition being regulated by the exigencies of each particular case. Mercury is now rarely given in any form of conjunctivitis, whatever may be its degree or character, experience having shown that it is destitute of controlling power. It is only when there is much disorder of the secretions that it should be thought of in connection with the disease. Anodynes must be given freely, whenever there is much local suffering, or inability to sleep, at every stage of the malady, and in all classes of subjects, unless there are strong and decided contra-indications; for besides answering these important purposes, they usually prove of immense benefit in affording quietude to the affected organ, an object of such great consequence in the treatment of inflammation generally. Elevation of the head and exclusion of the light will, of course, receive due attention.

Locally, none but the mildest remedies should be employed. It is a great mistake, yet one which is constantly committed even by men otherwise experienced, to use strong applications to the eye in every form and stage of the inflammation. Nothing can be more erroneous and unscientific, and, consequently, more prejudicial to the parts, than such a procedure. How often have I seen the simplest conjunctivitis, which in a few days might have disappeared spontaneously, converted into a most violent, obstinate, and protracted disease by the untimely use of a collyrium! If a collyrium be admissible at all, it is only, as a general rule, after the morbid action has been, in some degree, subjugated by other means, when it has assumed a subacute character, or when it is about to become chronic; in ordinary cases, I generally dispense with such applications altogether. When the symptoms are very urgent and threatening, I sometimes depart from this rule, but even then usually not without regret. In the purulent and gonorrhœal varieties of the affection, most ophthalmic surgeons urge the employment of strong collyria, even at an early stage of the attack, on the ground, as it is alleged, of their beneficial effects in controlling inflammation. I have used them myself in such cases, but seldom without



doubt and misgiving, if not the positive conviction of their injurious effects. I feel as if I could hardly inveigh too forcibly against this practice, knowing, from sad experience, what an immense amount of mischief it has done and is still doing.

The most valuable articles of this class of remedies are the different preparations of lead and zinc, wine of opium, and the nitrate of silver, the latter of which is at once the most potent and the most abused. The lead or zinc may each be used in the form of solution, in the proportion of one, two, or three grains of the salt to the ounce of distilled water, a few drops being poured upon the inflamed surface once or twice in the twenty-four hours. If the application smart beyond a few minutes, it must be weakened, or employed less frequently. The best preparation of opium is Sydenham's laudanum—the wine of opium of the shops—diluted with three or four parts of water, or dropped upon the eye in a pure state. The strength of the nitrate of silver should vary from the eighth of a grain to two grains for the more ordinary cases, while in the more violent, it may range from five to sixty. When the solution is very strong, it should be applied by means of a camel-hair pencil, the inflamed surface having been previously dried with a soft linen rag. When the lids also suffer, the best plan is to touch them and not the ball, their return to their natural position serving to diffuse the caustic over the whole of the diseased structure. Whatever collyrium be used, its effects must be carefully watched, and whenever they are found to flag, another must take its place. The solid nitrate of silver ought never to be used about the eye.

In the more severe cases of conjunctivitis, the patient will derive great comfort from poppy fomentations, cloths wrung out of warm water and opium, and the application of medicated steam, directed upon the eye by means of an inverted funnel. Sometimes a light poultice is very soothing, especially when the surface is wet with laudanum, or laudanum and acetate of lead.

In *purulent*, gonorrhœal, and other forms of ophthalmia, attended with unusual swelling and a rapid extension of the morbid action, the most appropriate measures are, free incision of the outer surface of the lids, extensive scarification of the chemosed conjunctiva, and the injection of the eye, every half hour, with a solution of opium and bichloride of mercury, in the proportion of two grains of the former and one-eighth of the latter to the ounce of tepid water. If the discharge of pus is very profuse, the inner surface of the lower lid may be pencilled over twice a day with a strong solution of nitrate of silver, as above directed. The bichloride of mercury is a remedy of great potency in all cases attended with copious puriform deposit. When the lids are enormously swollen I have found great benefit from the application to them of a large blister, the surface being well protected with gauze, to prevent the fly from falling into the eye. The use of the syringe I regard as of paramount importance in these cases, as it is the only means by which we can effect clearance of the irritating matter, and effectually medicate the inflamed surface. If these measures, aided by the constitutional remedies previously referred to,

cannot save the cornea and the deep structures of the eye, I confess myself unable to point out any other likely to be of service.

In the purulent ophthalmia of *infancy* I have usually effected excellent, and even rapid cures, by the injection every few hours of tepid water, or milk and water, followed immediately after by a solution of bichloride of mercury, from the eighth to the twelfth of a grain to the ounce of water, and the constant application of a light elm poultice, medicated with acetate of lead, and frequently renewed. Internally, we may give, every eight hours, a minute quantity of Dover's powder, with the twelfth of a grain of calomel, or the same quantity of calomel and ipecacuanha, to act upon the skin, to allay pain, and to quiet the diseased structures. The bichloride of mercury is, of all the local remedies that I have ever tried in this affection, the most efficacious in its action, making generally a most rapid and decided impression upon the discharge. Very weak solutions of lead, zinc, and alum are also advantageous, but altogether inferior to the bichloride. One of the great points in the treatment of this and other forms of purulent ophthalmia is to get rid of the acrid secretions, which, if allowed to remain, always act as local irritants. As to leeches and counter-irritation, I never employ them in this disease as it occurs in infancy.

If the child is feeble, a minute quantity of quinine is given three or four times a day, and in all cases proper care is taken that it obtain a sufficiency of good nourishment from the mother. As the disease improves, exercise in the open air is enjoined.

It is often very difficult to obtain a satisfactory view of the condition of the eye in this affection, owing, as before stated, to the excessive tumefaction of the lids. The proper way to accomplish this object is to place the child's head between the knees, and then to draw the lids gently apart with the index fingers, no attempt being made at eversion, which, under such circumstances, is quite impossible. The eye should always be well syringed a moment before the examination, to prevent the matter from obscuring the ball.

In regard to *granular conjunctivitis*, the practice of ophthalmic surgeons has hitherto been eminently uncertain, if not empirical. Without detailing what others have said upon the subject, I shall content myself with giving an outline of the treatment which I have myself usually found most efficacious, premising that I have seen many hundred cases of the disease, in all its gradations, from the mildest to the severest, from the most transient to the most protracted and rebellious.

The first thing that should claim our attention is the state of the general health, which is often seriously deranged, in consequence of the joint agency of disease, confinement, and ill treatment. Purgatives are generally indicated, and often afford immense relief; the diet must be carefully regulated; exercise must be interdicted; and, if there be much pain, interfering with sleep, a full anodyne must be administered at night, either by itself or along with a diaphoretic, or a drachm of the wine of colchicum, the latter being particularly serviceable when the pain is of a rheumatic character, or diffused over the side of the head. If the patient is plethoric, the antimonial and saline mixture

must be given three or four times a day, along with a small quantity of morphia in each dose. When the cutaneous surface is at fault, Dover's powder is an excellent remedy, given every night towards bedtime in doses of fifteen or twenty grains, and under similar circumstances a tepid salt bath is sometimes useful. The bowels must be moved by medicine regularly every fourth day, for I consider systematic and thorough purgation as of paramount importance; and the diet must be light and farinaceous, without being too nutritious. The only form of counter-irritation which I have of late years employed is the seton, introduced into the corresponding arm, or into both limbs, if the disease involve both eyes.

Dr. C. S. Fenner, of Memphis, has used with great advantage in this complaint a strong decoction of *phytolacca*, given in wineglassful doses every two or three hours until it causes pretty active purgation, when it is administered in smaller quantity, or at longer intervals. It is considered particularly valuable in the rheumatic form of the malady, attended with severe pain in and around the eye.

If the granulations are very large and exuberant, I evert the lids and shave them off with a sharp scalpel close down to the conjunctiva, without including this membrane in the operation; and having encouraged the flow of blood as long as possible with a sponge and tepid water, I immediately cauterize the raw surface with a stick of sulphate of copper, expressly prepared for the purpose. The part, being again exposed to a stream of water, to get rid of the redundant salt, is permitted to resume its natural position; the patient being directed to bathe the eye frequently for the next two days, and to anoint the edges of the lids at night with a little thick cream or fresh lard. If, on the other hand, the granulations are comparatively insignificant, I dispense with the use of the knife, and resort at once to the application of the copper. This should be repeated every third or fourth day, care being taken always to dry the surface previously with a soft rag, and to wash off the redundant salt. The copper is never applied directly to the ball or lower lid, as that on the upper lid soon diffuses itself over the whole of the inflamed surface. In the intervals of the cauterization, the eye is bathed, more or less frequently, with cool, tepid, or cold water, simple, mucilaginous, or slightly astringent, as may be most agreeable to the part and system, or favorable to the reduction of the morbid action.

Instead of the copper, I sometimes use a strong solution of nitrate of silver, twenty, thirty, or even sixty grains to the ounce of water, applied very carefully by means of a camel-hair pencil to the inner surface of the upper lid, also previously everted and dried. The two remedies may occasionally be advantageously alternated. Pencilling the granular surface with Goulard's extract is now and then followed by speedy amendment; but, on the whole, it is inferior to the copper and nitrate of silver. The great objection to this article, and also to the ordinary solutions of lead, is their liability to incrust the cornea, and thus produce mechanical obstruction.

When the reproductive tendency of the granulations is very great, I have found marked benefit from frequent scarification of the lid, and



the occasional application of two or three leeches to the neighborhood of the outer canthus. I know that the former of these remedies has met with much opposition, but I can attest its beneficial effects from ample experience.

When the general health is enfeebled, a tonic course of treatment will be required, and this will be the case with a majority of the patients whom we are obliged to attend in our larger cities, and in the wards of the more crowded hospitals. Under such circumstances signal benefit will accrue from the use of quinine and iron, iron and extract of bark, cod-liver oil, and similar articles, with a nutritious diet, exercise in the open air, and attention to the skin. Whatever means be adopted, steady perseverance, both on the part of the patient and his surgeon, will be indispensable to a final and permanent cure. All indiscretions must be avoided, for there is no disease more liable to relapse than granular conjunctivitis.

The corneal opacity, which is so common an attendant upon this disease, unless very great, usually disappears as the lids regain their normal condition. Should it be slow in going away, the cure may be expedited by the daily application to the edge of the lower lid of a little very dilute ointment of the oxide of zinc, nitrate of silver, or red oxide of mercury. The same means will also be useful in effecting the removal of the granulations.

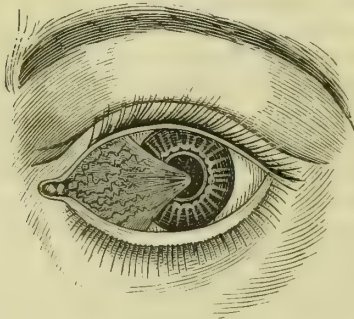
Finally, in concluding my remarks upon the treatment of conjunctival ophthalmia, I feel it my duty to impress upon the mind of the practitioner the indispensable necessity, in every case attended with muco-purulent discharge, of isolation of the patient as far as the use of his bed, towel, and basin is concerned; for, although it would be absurd to say that every discharge of the kind is contagious, yet we cannot observe too much circumspection in regard to those whose duty compels them to be constantly in contact with the subjects of these maladies. If we must err, it is certainly best to err upon the side of safety.

*Pterygium.*—Pterygium is a membranous growth of the conjunctiva, or, more properly speaking, a hypertrophous state of the conjunctiva, generally remarkably vascular, several shades darker than the surrounding surface, and of a triangular shape, the apex corresponding to the cornea, and the base to the outer canthus (fig. 177). It is commonly situated upon the nasal aspect of the eye, but it may occur upon the temporal side, or even in the perpendicular diameter of the organ. Only one such growth is ordinarily met with; in some cases two are observed (fig. 178), and instances have been recorded where there were as many as three, and even four, although such a phenomenon is extremely rare. Sometimes, also, the pterygium, instead of being horizontal or perpendicular, is more or less oblique, and deviates remarkably from the triangular form.

The starting point of a pterygium is generally a short distance from the cornea, presenting itself in the form of a little elevation, of a vascular and somewhat yellowish appearance, which, gradually assuming a membranous form, extends, on the one hand, outwards towards the canthus of the eye, and, on the other, inwards towards the cornea,

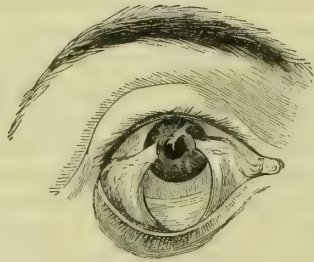
upon which it always encroaches to a greater or less extent, rarely, however, in any case, passing beyond the middle line. When it is developed upon the nasal side of the eye, it generally, in its progress,

Fig. 177.



Pterygium.

Fig. 178.



Double pterygium.

involves the semilunar valve, and hence it has sometimes been supposed, though erroneously, to originate in that structure. The causes which give rise to pterygium are generally such as produce chronic inflammation, but in many of the cases which have fallen under my observation it came on spontaneously, without any antecedent or accompanying disease of this kind.

Pterygia vary much in their structure; some are quite thin, as if they consisted merely of an additional layer of conjunctiva; others, on the contrary, are very thick, and of a tough, fibrous consistence. Numerous vessels, generally arranged in a straggling manner, and occasionally little granules of fat, usually exist in them; but in cases of long-standing they are often very white, and non-vascular. That they consist mainly in a hypertrophous condition of the conjunctiva, is shown by the fact that the morbid growth is inseparably incorporated with that membrane, that it always lies loosely upon the sclerotica, and that it follows the conjunctiva in its reflection over the cornea, where its attachment is always extremely close and firm.

The principal inconvenience of a pterygium is of a mechanical character, interfering somewhat with the movements of the eye. It is seldom productive of pain, but the subjects of it are more prone to inflammation than common persons. Vision is not materially impaired, except when the membrane encroaches considerably upon the cornea. The affection is much more common in elderly subjects than in young, and in men than in women.

Nothing is to be expected from local applications in pterygium, even in its earlier stages; I would, therefore, strongly advise against any measures of this kind, nor would I recommend interference so long as the eye is comparatively comfortable, and vision is not materially impaired; the disease is attended with no danger to the eye, and unless the patient is very particular about his appearance, he may as well put up with his inconvenience, for it really seldom amounts to anything more.

Should an operation be demanded, it is easily executed by seizing the pterygium at its middle with a pair of forceps, and, drawing it away from the globe, shaving it off with a narrow scalpel. Special care is taken to dissect away its corneal attachments, which, as already stated, are always very firm. Some surgeons prefer making the excision with the scissors, but I am satisfied that the operation can be performed much more effectually, though perhaps not so rapidly, with the knife. As soon as the morbid growth has been removed, a piece of sulphate of copper should be gently applied to the wound, especially to its corneal portion, in order to prevent a recurrence of the disease, to which there is generally, especially in elderly subjects, a remarkable proclivity. The application is afterwards repeated every fourth or fifth day, until it is found that all repullulating tendency has ceased. A few leeches, applied near the canthus of the eye, will sometimes greatly accelerate the cure.

*Xeroma.*—The word xeroma is employed to denote a remarkable dryness of the conjunctiva, chronic in its character, and associated with more or less thickening, and induration of the membrane, which looks more like skin than mucous tissue. The best idea that I can give of the diseased structure, is, that it resembles the eyelid of the land frog, and similar reptiles. The morbid change is usually universal, affecting the entire conjunctiva, although it is commonly most distinctly marked in the ocular portion. In two of the three cases that have fallen under my observation, it was also very conspicuous in the epithelial lining of the cornea, which was singularly dry, slightly opaque, and studded with little grayish points, not larger than a clover seed. Of the origin and nature of xeroma we have no definite information. It has generally been ascribed to the effects of inflammation, but if this disease is capable of producing it, why does it not more frequently follow in its wake? Xeroma is extremely rare, while conjunctivitis is one of the most common of maladies. Again, it has been supposed to be caused by deficient lachrymal secretion; but such a state has been assumed rather than established by direct observation, and in a number of the reported cases of the disease it has been most satisfactorily demonstrated that the functions of the lachrymal gland were not materially, if at all, impaired. Nor can the affection be justly ascribed to a want of the proper secretion of the conjunctiva, seeing that the suppression of this secretion is a consequence, and not a cause of the morbid change. Xeroma is usually confined to one eye, the sight of which is necessarily more or less impaired, if not wholly destroyed. The three cases, which I have had occasion to observe, all occurred in old subjects; they had been in progress for many years, were attended with nearly total blindness, and came on without any assignable cause. A stiff, dry feeling of the eye, with some impediment of motion, was the chief inconvenience under which the patients labored.

Xeroma is an incurable affection. Temporary improvement sometimes follows the use of mildly stimulating unguents; but beyond this, nothing is to be hoped for from local applications. In cases of recent standing, it might be justifiable to try the effects of excision of the diseased membrane, removing it in large sections at three or four sit-



tings, at intervals of so many weeks. Such a procedure might, unless the regenerative tendency is very great, be perfectly successful.

*Encanthis.*—The lachrymal caruncle and the fold of the conjunctiva, called the semilunar valve, are liable to hypertrophy, known under the name of encanthis (fig. 179). The enlargement, which occasionally attains a considerable bulk, extends along the inner margin of the lids, impedes the movements of the eye, and keeps up more or less irritation, with discharge. The tumor is often connected with obstruction of the lachrymal passages, and generally has an angry, reddish appearance. The proper remedies are leeching, scarification, and the application of nitrate of silver, with attention to the general health, which is frequently

Fig. 179.



Encanthis.

involved in the causation of the disease.

A malignant tumor, of a mixed scirrhus and encephaloid character, sometimes springs from these structures; it is of a livid or purple hue, rough, knotty, or tuberculated on the surface, hard to the touch, and rapid in its growth, often attaining a considerable bulk in a few months. Its tendency is to progress, ulcerate, fungate, and finally to destroy life. Early and thorough excision affords the only chance of relief, which, however, is always a very remote and unsatisfactory one.

*Diseases of the Submucous Tissue.*—The only affections of the sub-conjunctival cellular tissue requiring notice, are, hemorrhagic effusions, cedema, fatty deposits, and the little parasite, called the cellular cysticerce.

*Blood* may be effused into the sub-conjunctival cellular tissue by accident, as a blow, or spontaneously, without any apparent cause, mental or physical. Of the latter variety I have seen several instances, chiefly in young persons, who were otherwise in the most perfect health. The occurrence is unattended with pain, and the extravasated blood is either limited to one or two small points, or extensively diffused over the anterior part of the eyeball. The resulting redness is altogether different from that of inflammation, and cannot be mistaken by any one at all familiar with ophthalmic affections. Very little is necessary in the way of treatment; indeed, the fluid usually rapidly disappears of its own accord. When the patient is very solicitous about himself, the discussion may be promoted by the use of astringent lotions, or a poultice composed of equal parts of the scraped root of the black bryony and the crumbs of bread, renewed from four to six times in the twenty-four hours.

*Edema* of the areolar tissue beneath the conjunctiva is of two kinds, the passive and active. The first is the result of a slow effusion of serum, in consequence usually of a retarded state of the venous circulation, of which the exciting cause is compression by some tumor, abscess, or other obstruction; the conjunctiva is elevated in the form of a small bladder, of a white, almost shining appearance, soft and inelastic, and perfectly free from pain. The active variety, usually known under the name of chemosis, is a much more serious disease;

it has already been described in connection with purulent ophthalmia, with which it so often co-exists, and of which it forms one of the most dangerous complications, from its tendency to induce gangrene of the cornea. It is always produced under the influence of inflammation, and is frequently of a sero-fibrinous character, instead of being purely serous, as in the passive form. When it exists in its highest grade, the swelling forms a ring around the cornea, often a few lines deep, by which this membrane is sometimes nearly buried. The proper remedy, as before remarked, is free scarification, to afford vent to the effused fluids, followed by the application of a weak solution of nitrate of silver. Nothing short of this will be likely to save the cornea.

A little *fatty tumor* occasionally forms beneath the conjunctiva, from the size of a currant to that of a pea, irregularly rounded, movable, and of a pale yellowish color. It generally receives a few straggling vessels, grows slowly, and is surrounded by a thin layer of condensed cellular tissue. The proper remedy is excision.

A species of hydatid, the *cellular cysticerce*, has been met with in this situation; the containing vesicle is about the size of a pea, and looks like a little bladder filled with water. Under the microscope the parasite is seen to have its mouth encircled by distinct hooklets. It is sometimes developed at a very early age. The only remedy is extirpation.

#### DISEASES AND INJURIES OF THE CORNEA.

The most common affections of the cornea are wounds, inflammation, abscess, gangrene, ulceration, opacity, change of form, technically termed staphyloma, and fatty degeneration. Foreign bodies are also liable to enter it.

1. *Wounds*.—Wounds of the cornea may be the result of accident or design, and are either incised, punctured, or lacerated, according to the kind of weapon with which they are inflicted. Incised wounds are generally caused by pen-knives and similar instruments; punctured wounds, by needles, pins, thorns, and splinters of wood; lacerated wounds, by percussion-caps, pieces of glass, particles of iron, and fragments of stone. Sometimes the cornea is ruptured by a severe blow or fall upon the eye. However induced, the injury is always attended with an escape of at least the aqueous humor, if not also of the lens and the vitreous humor, thus greatly complicating the case, and often permanently injuring vision. Another accident, also frequently of a very serious nature, is prolapse of the iris, varying in extent, according to the size of the wound, from the smallest pin-head to nearly the whole membrane. Finally, another source of complication is the penetration of the vulnerating body into the interior of the eye, and its retention in the humors or tunics of the organ. Unless the lesion is considerable, there is seldom much hemorrhage; nor is the pain generally so great as we might suppose from the delicate structure of the cornea.

Wounds of the cornea, even when of considerable size, may easily be overlooked, especially when there is no separation of their edges,

because of the liability of the membrane to preserve its normal appearance. In general, however, we have no difficulty in arriving at a knowledge of the nature of the case by standing behind the patient, and looking at the cornea, as the eye, turned towards the light, is moved about in different directions, the lids being at the time held carefully out of the way. In addition to this, the iris often presents a peculiarly collapsed appearance, contrasting strikingly with that which it exhibits in the normal state.

Little superficial abrasions, resembling the merest possible scratches of the skin, are now and then found upon the cornea, as the result of external violence; they involve simply the epithelial covering of the membrane, and are distinguished by the exquisite pain which attends them, which is often much greater than when the wound is deep and extensive.

The first indication, in wounds of the cornea, is to clear away foreign matter, and to replace the prolapsed iris; the second, to control the movements of the eye, and to moderate the resulting inflammation.

If the vulnerating body is imbedded in the substance of the cornea, it should be carefully withdrawn with the forceps; if it has passed beyond, into the interior of the eye, and is accessible, it may, perhaps, be extracted in a similar manner; at any rate, an attempt should be made to seize and dislodge it, well knowing that, if it be permitted to remain, it will not only produce destructive inflammation, but become a source of the most horrible suffering, for which it may be necessary, at a subsequent period, to evacuate the humors of the organ. It is, of course, needless to caution the young surgeon about officious interference in these cases, especially all rude and extensive probing, which might prove worse than the retention of the extraneous substance. Among the more unfortunate accidents of this kind that we meet with in this country are lacerated wounds of the cornea, made by percussion caps, which often pass through the iris into the vitreous humor, causing violent and destructive inflammation, followed by almost insupportable pain, lasting as long as the foreign body remains in the eye. I have seen more than a dozen such cases, in every one of which the sight was completely lost, and the pain of the most violent character. If probing of the eye is ever justifiable, it is under such circumstances; and I am not certain whether we should not extract the foreign substance at all hazard. By putting the patient under the influence of anæsthesia, the operation might be conducted with comparative safety, and with greater probability of success.

Replacement of the iris is best effected with a delicate probe, the patient, especially if a child, being under the influence of chloroform. Unless this be the case, it will often be extremely difficult to succeed in our efforts. The surgeon, availing himself of the temporary calm, restores the prolapsed membrane, and carefully adjusts the edges of the wound, which generally unites by the first intention, leaving little, if any, defect in vision. If the lens becomes opaque, in consequence of having been involved in the lesion, the case is afterwards treated as one of ordinary cataract.

The second indication is fulfilled by strapping the lids of both eyes,



keeping the patient in a dark room, and employing the antiphlogistic regimen. A full anodyne is administered immediately after the accident. The patient must be closely watched, and if he be plethoric, we should not hesitate to remove blood by the lancet and by leeches. Care must be taken, however, not to carry the depletion too far, otherwise we may seriously interfere with the reparative process.

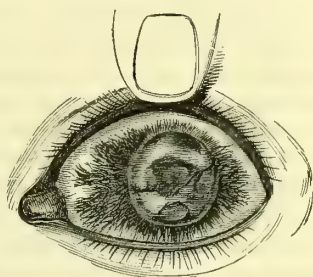
2. *Corneitis*.—Corneitis (fig. 180) is characterized by a hazy state of the affected surface, and a zone-like appearance of the vessels at the periphery of the cornea, which is often quite vascular for the distance of nearly a line beyond this point. The vessels are greatly engorged, yet so extremely delicate as to render it difficult to distinguish them well without the aid of a magnifying glass. The conjunctiva, iris, and sclerotica usually participate in the morbid action, and hence the case is apt to exhibit the characters common to inflammation of all these structures. The opacity of the cornea begins at an early period of the disease, and sometimes extends over the whole surface of the membrane, although, in general, it is more distinctly marked at some points than at others. Its immediate cause, of course, is an interstitial deposit of plasma.

The pain of corneitis is severe, and is seldom limited to the inflamed membrane, but extends to the other structures of the eye, the orbit, temple, cheek, and forehead. Hemicrania is often a marked symptom. The eye is exceedingly intolerant of light, and there is abundant lachrymation, although but little secretion of mucus, or deposit of muco purulent matter. When the inflammation is unusually violent, there may be constitutional involvement, as indicated by fever and other disorders; but in most cases, there is an absence of general derangement. The characteristic phenomena are the opacity of the membrane, and the zonular arrangement of the vessels at its circumference. In iritis, the vascular zone does not extend quite so far forward; hence there is always a narrow ring of comparatively healthy sclerotica between it and the cornea.

The causes of corneitis are various, and often difficult of recognition; in most of the cases, however, that fall under the observation of the American practitioner, the disease is induced by external injury, or by a scrofulous taint of the system. The eruptive fevers, as measles, scarlatina, and smallpox, are frequently followed by a bad form of corneitis. In rheumatic and syphilitic scleratitis, the cornea is very apt to participate in the morbid action.

Corneitis may terminate in resolution, the haziness and vascularity of the affected tissues gradually disappearing; or it may pass into the chronic state; or, finally, it may lead to suppuration, ulceration, or gangrene.

Fig. 180.



Corneitis.

In the *treatment* of corneitis, care must be taken not to carry our antiphlogistic measures too far, as we should be likely to do, if we were to adopt, without reserve, the injunctions of some ophthalmic writers. Unless the action is extremely violent, we shall rarely have occasion for the use of the lancet, or even the application of leeches, the disease generally yielding, in due time, to gentle, but steady, purgation, abstinence, the antimonial and saline mixture, and the exclusion of light. The eye is kept in a state of quietude by anodynes, given either in small and repeated doses, or, what I prefer, in one full dose, once or twice in the twenty-four hours.

When the disease is of a strumous nature, the best remedy, according to my experience, is quinine, along with a minute quantity of antimony and opium, steadily persevered in for many weeks. Where there is an anemic condition of the system, the quinine and other articles here mentioned, may be advantageously combined with some preparation of iron, as the iodide, sulphate, or precipitated carbonate.

Should the inflammation be plainly of a rheumatic origin, colchicum will be indicated, in the manner detailed under the head of sclerotitis. The syphilitic form of the disease is to be treated with mercury and opium, either alone, or in combination with iodide of potassium.

Inflammation of the cornea dependent upon measles, scarlet fever, and smallpox, must be treated with mild means, as poppy fomentations, tonics, especially quinine, anodynes, and a supporting diet. Active treatment is out of the question.

When corneitis, however induced, becomes chronic and rebellious, benefit will accrue from change of air, tepid bathing with salt water, tonics, and gentle, but steady, counter-irritation.

3. *Abscess*.—Abscess of the cornea is an occasional consequence of acute inflammation, especially of the traumatic and variolous forms; it is also met with, but much less frequently, in the strumous variety of the disease. The matter may be situated immediately beneath the epithelial covering of the cornea, but more commonly it is found in its substance, nearly equi-distant from its two surfaces, not in a distinct, circumscribed cavity, as the term abscess would imply, but as an infiltration among the softened and disorganized fibres of the membrane. The matter, which is of a yellowish hue, is not true pus, but a mixture of pus and lymph, and hence it is always remarkably tough and viscid. The suppurative process is generally limited to a particular portion of the cornea, usually the central or inferior, but we now and then meet with cases where it is spread over its whole surface.

The formation of matter is denoted by a yellowish appearance of the cornea, and by a marked aggravation of all the local symptoms. As the fluid accumulates, the cornea becomes more prominent, and finally yields at the most diseased part, followed by an imperfect escape of its contents. It is not always, however, or perhaps even generally, that the abscess points externally; on the contrary, it frequently bursts its posterior wall, and discharges itself into the aqueous humor.

Suppuration of the cornea, unless extremely slight, is one of those untoward circumstances, the effects of which are never entirely reco-

vered from; indeed, when the quantity of matter is considerable, the resulting opacity generally eventuates in total blindness. Hence, the practitioner should spare no pains to prevent its occurrence. The moment he finds that it is likely to take place, he should redouble his efforts to bring about resolution; he must be cautious, however, that he does not carry his antiphlogistic measures too far, otherwise he will be sure to accelerate the crisis instead of successfully counteracting it. If the patient be plethoric, additional depletion may be called for and well borne; but the reverse may be the case; he may be pale and exhausted from suffering and previous treatment, and then stimulants and tonics, with nutritious food and drink, may be proper. Much judgment will, therefore, be required to enable us to steer a correct course; one calculated to save structure and function. In regard to mercury, so frequently recommended in this affection, I believe that it will generally be found to be prejudicial, and it would probably be well if its use were dispensed with altogether. Locally, none but the blandest remedies should be employed. Puncture of the abscess may be had recourse to in the event the matter is concentrated, to afford an opportunity for gradual drainage; but under opposite circumstances it will be well to let it alone, trusting to the operations of nature.

When the abscess bursts both externally and internally, there will be a gradual collapse of the anterior chamber; the iris will fall forwards against the cornea; and vision will be irretrievably destroyed.

4. *Gangrene*.—Gangrene of the cornea is a frequent occurrence. It is most common in persons of a delicate, feeble constitution, after the operations for cataract, and the more severe forms of ophthalmia, especially those consequent upon smallpox and the contact of specific matter. It is often produced by escharotic substances. Chemosis, a disease previously described, is very liable to produce gangrene of this structure, unless the greatest care is taken in its treatment to prevent the strangulation of the vessels of the cornea. When this event is about to take place, there is a great and rapid increase of opacity, and the membrane soon assumes a sodden, macerated, and corrugated appearance. The local symptoms suddenly increase, but as the gangrene spreads the pain usually very sensibly diminishes in intensity. A deposit of pus often precedes the occurrence of gangrene.

When gangrene is threatened, all depletory measures must, as a general rule, be at once dismissed, and the patient put upon tonics and stimulants, with a good nutritious diet, aided, if he be at all enfeebled, by milk punch and other suitable means. The cornea is touched every six or eight hours with a weak solution of nitrate of silver, consisting of about two grains to the ounce of water, and the system is kept under the full influence of opiates, both to insure quietude to the eye and to promote sleep. If mercury have been previously used, it is immediately discontinued, as it cannot fail, if persisted in, to do serious harm, by still further depressing the part and system.



5. *Ulceration.*—Ulceration of the cornea (fig. 181) is a very common event of inflammation, both of the traumatic and specific kind. We frequently see it as a consequence of the lodgment of a foreign body, and also as a sequel of strumous, variolous, morbillous, and other forms of ophthalmia. The peculiarity of its structure, indeed, renders this membrane quite prone to this species of morbid action; it bears a very close resemblance to articular cartilage, and the slightest causes are sometimes found to lead to its erosion. Disease of the fifth pair

Fig. 181.



Ulceration of the cornea.

of nerves is a source of ulceration of the cornea. It is probable that the protracted use of unwholesome food, especially of articles deficient in azotized matter, may induce the affection by producing an impoverished state of the blood; a condition of the system ill calculated to resist the effects of inflammation. Once set up, it is often difficult to arrest its progress, and to prevent the formation of disfiguring and injurious cicatrices. The disease may occur at any period of life, and under almost every possible variety of circumstance as to constitution and health, but is most common in young subjects of a feeble, delicate organization.

Ulcers of the cornea present themselves in every possible form and size, so much so as to render it very difficult to furnish an accurate description of them. The most common variety, perhaps, is the dimple-shaped erosion, in which the part has an excavated appearance, as if a solid portion of the cornea, comprising several of its layers, had been scooped out. In another series of cases the ulcer looks like a superficial abrasion, involving merely the epithelial investment of the cornea. In the third place, the ulcer may be almost perfectly circular, and not larger, perhaps, than the diameter of a pin; this form of erosion is by no means infrequent, and is the more interesting because of its proneness to lead to perforation. Whatever form a corneal ulcer may assume, its edges are generally somewhat everted, and more or less irregular, if not ragged, as may easily be seen by a careful inspection with the aid of a glass. It is seldom that we find them inverted or undermined; cases occur in which they are very steep and abrupt, as if a piece had been cut out of the cornea with a punch. In general they have a slight hazy appearance, especially when cicatrization is about to begin, or has already made some progress. The bottom of the ulcer is either natural, or it is of a pale ash hue, and more or less irregular. In regard to size, ulcers of the cornea vary from that of a clover-seed to that of a split pea.

Ulcers of the cornea are generally attended with considerable pain, lachrymation, and intolerance of light, along with more or less vascularity of the diseased structures. If their progress be not early checked, they may extend in depth until they cause perforation of the membrane, followed by an escape of the aqueous humor and prolapse of the iris. Another bad effect to which they are apt to lead is incurable opacity, a natural result of the reparative process, especially when the erosion is of any depth or extent.

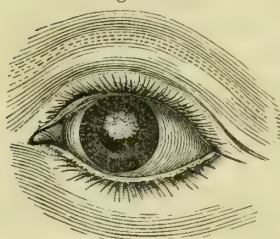
Unless great care be exercised, an ulcer, even of considerable size, may exist upon the cornea, and yet entirely escape detection. To conduct the examination in a proper manner, the surgeon should stand behind the patient, who sits with his face fronting the window. The eye being now depressed, while the lids are held out of the way, the light will fall in a full stream upon the cornea, and thus disclose any breach that may exist upon its surface.

The *treatment* of ulceration of the cornea requires more judgment than practitioners are usually aware of; perhaps I ought to say than they usually possess. Under an idea that the disease is generally one of over-action, the plan commonly pursued is to deplete the patient, if not by the lancet, at least by leeching and purgation, to a point beyond what is proper for the restorative process. The consequence too often is that the disease is aggravated instead of being relieved. Experience has shown me that, in nearly every instance, the affected part will be immensely benefited by an invigorating plan of treatment, consisting in the liberal use of quinine, or quinine and iron, along with a nutritious diet, and a full anodyne at least once in the twenty-four hours, especially if there be much pain. When the system is plethoric, and when there is an unusual degree of vascularity of the cornea and other structures, a few leeches occasionally to the neighborhood of the outer canthus, and the steady, but moderate use of the antimonial and saline mixture, with a grain or a grain and a half of quinine to every dose, will go far in putting a speedy stop to the disease.

As it respects direct applications, the fewer we make, as a general rule, the better. Under the means just pointed out, the reparative process usually proceeds very kindly, and, unless the breach is uncommonly large, little or no opacity may be expected. It is only, or, at least, principally, when there is a disposition in the ulcer to extend, as when it has a foul, unhealthy aspect, that local remedies are at all called for, and then great care should be taken that they are as mild and soothing as possible. Of these, the most eligible is a solution of nitrate of silver, in the proportion of from two to ten grains to the ounce of water, applied directly to the sore by means of a very small camel-hair pencil once a day, or every other day, according to the exigencies of each particular case. A very dilute ointment of the oxide of zinc, or oxide of mercury, also answers a good purpose, but is, on the whole, inferior to the caustic. When the ulcer is of an unhealthy, phagedenic, or sloughing character, its surface may be touched with a stronger solution of nitrate of silver, or this article may be applied very gently in substance, shaped to a very minute point.

6. *Opacity*.—Opacity of the cornea exists in various forms and degrees, from the smallest visible speck to a patch large enough to cover its entire surface. A hazy appearance of the membrane is present in almost all cases of corneitis, however slight. The more marked and concentrated forms of opacity are generally the result of the cicatrization of deep ulcers and badly healed wounds. When the opacity is slight, it is usually designated by the term *nebula*, literally signifying a cloudy condition of the part; the hard, white, milky,

Fig. 182.



Opacity of the cornea.

concentrated spot, on the contrary, is known by the name of albugo (fig. 182). As meaning the same thing, the word leucoma is sometimes employed. The distinction between nebula and albugo has a real, practical significance; the former often disappearing spontaneously, or under very simple measures, whereas the latter seldom wholly subsides, whatever treatment may be adopted for the purpose. Nebula, as it usually presents itself, is situated either in the epithelial

investment of the cornea, or immediately beneath it, in the superficial layer of this membrane, and often occupies a large extent of surface; in some cases it is seated more deeply, and instances occur, although they are rare, in which it is seated between the membrane of Demours and the posterior lamella of the cornea. Albugo, which frequently embraces the entire thickness of the cornea, is generally very hard and dense, white, milky, or chalk like in its appearance, and of a circular, linear, or angular shape, its surface being sometimes smooth, at other times rough. It is essentially an analogous tissue, but so imperfect a copy of the original that it can hardly be said to bear any resemblance to it. Finally, cases occur in which this substance is partially transformed into fatty matter, fibro-cartilage, cartilage, and even bone.

The slighter forms of corneal opacity often disappear with the inflammation which has produced them, or within a short time after, under the influence simply of the absorbents, now no longer kept in abeyance by the secretions. Should the case prove tedious, or not proceed satisfactorily, measures must be taken to promote the removal of the effused matter, among which the best are alterant tonics, as quinine and iodide of iron, with a very minute quantity of tartar-emetic, as the one-twentieth of a grain, three times a day; iodide of potassium; or a very mild course of mercury, carried to the extent of the slightest possible ptyalism. The cure will be expedited by the use of some mild local stimulant, as a few drops, twice a day, of a very weak solution of acetate of zinc, nitrate of silver, or acetate of lead, or a very weak ointment of oxide of mercury, nitrate of silver, or oxide of zinc. I have derived great benefit, under such circumstances, from a little thin molasses poured upon the opaque cornea once a day, and also from washing the eye night and morning with tepid water, rendered gently stimulating with a little common vinegar or salt. Indeed, almost any substance, provided it does not act as an irritant, will prove useful in most cases of nebula.

For albugo in its various forms, surgery holds out no prospect of relief; it is an organized tissue, part and parcel of the cornea, and no remedies, either local or general, can remove it. The idea of curing an albugo by paring it away is simply ridiculous, and implies a very imperfect knowledge of the nature of the disease. The operation of excision, and of uniting the wound by suture, proposed by Dieffenbach, is still more preposterous; and the recent suggestion of Dr. Nuss-



baum, to cut out the opaque spot, and make the patient wear a small piece of glass, shaped like a shirt-stud, caps the climax of absurdity. When the opacity does not affect the entire centre of the cornea useful vision may occasionally be procured by constant dilatation of the pupil with atropia.

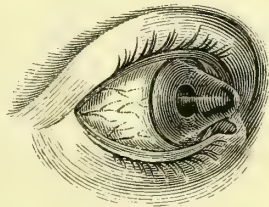
7. *Staphyloma*.—Alterations of form of the cornea are technically known under the name of staphyloma; they are an occasional effect

Fig. 183.



Spherical staphyloma.

Fig. 184.



Conical staphyloma.

of inflammation and external injury, and occur in every intermediate degree, from the slightest aberration of the normal shape to the most hideous deformity. Two principal varieties of the disease are usually recognized by authors, the spherical (fig. 183), and conical (fig. 184), but as they do not differ from each other in their character or mode of development, the distinction might as well be abolished, as it is only calculated to lead to erroneous notions of pathology and practice.

The immediate *cause* of staphyloma is a weakened and attenuated condition of the cornea, especially of its central portion, in consequence of which it is incapable of resisting the pressure of the aqueous fluid as it accumulates, now in increasing quantity, in the anterior chamber. More or less opacity and a certain degree of abnormal vascularity attend the development of the disease, the progress of which is always tardy, several years usually passing by before it attains much bulk. The tumor is commonly of a conical form; and as it proceeds, it gradually projects beyond the lids, separating them from each other, and descending towards the cheeks, its length varying from a few lines to several inches. That portion which lies beyond the level of the lids is usually very hard, more opaque than the rest, and constantly inflamed, from the fact that it is incessantly exposed to the light, and the contact of all sorts of irritants. When the disease is fully developed, the anterior chamber is annihilated, the iris being lacerated, and closely adherent to the posterior surface of the cornea. Vision is always greatly impaired, and often completely destroyed. The staphyloma, after having attained a certain height, remains either stationary, or ulceration sets in, followed by perforation of the membrane, and the escape of the aqueous humor.

There is a form of this affection which appears to consist in a hypertrophous condition of the cornea, its development being altogether independent of inflammatory action. The affection involves both eyes, though rarely in an equal degree, and is most common in young subjects, from the age of eighteen to thirty. The tumor is smaller

than in the inflammatory variety, and also retains a greater amount of transparency, the opacity being generally limited to the part projecting beyond the lids. The iris preserves its normal position, the pupil moves with its accustomed freedom, and the anterior chamber, instead of being obliterated, as in the ordinary form of the disease, is only enlarged and changed in shape. Vision is more or less impaired, and the cornea is remarkable for its glistening, sparkling appearance. The cause of the lesion is not understood.

In the incipient stage of staphyloma a gently antiphlogistic course will sometimes be of service, if not in permanently arresting the disease, at all events in staying for a time its progress, and in preventing it from attaining so great a development as it otherwise would. The best remedies will be mild astringents, particularly the different preparations of nitrate of silver, ointment of the oxide of mercury, and solutions of zinc and lead, with frequent puncture of the cornea to take off the pressure of the aqueous humor. In general, however, these means will fail, and the surgeon will, therefore, be compelled to resort to other measures, especially if the tumor has attained so much bulk as to be constantly irritated by the contact of extraneous matter. The most appropriate remedy in this case is excision of the cone, or of all that portion which projects beyond the edges of the lids. For this purpose, the lids being held carefully out of the way, the apex of the tumor is transfixed with a tenaculum, and the knife—a sharp, narrow bistoury—is rapidly carried from above downwards, cutting off the requisite amount at a single sweep. Care is taken not to remove too much, otherwise the eye may either collapse from the evacuation of its humors, or, at all events, shrink so much as to interfere with the wearing of an artificial one.

For the non-inflammatory species of conical cornea there is no cure. The probability is, as before stated, that it is merely a form of hypernutrition, and if this opinion be correct, it is not surprising that it should be entirely beyond the control of remedies.

8. *Fatty Degeneration*.—Fatty degeneration of the cornea is rather of pathological than of surgical interest, and may, therefore, be dismissed in a few words. This affection, formerly known under the name of the senile arch, has been shown, within the last few years, to consist essentially in a transformation of the horny tissue of the eye into a substance resembling fat; it is of a dim pearl color, loaded with oily matter, and considerably softer than the adjacent healthy structure, in which it is insensibly lost. The altered part presents itself in the form of a ring, at the periphery of the cornea, near its junction with the sclerotica. The fatty transformation is not peculiar to the old, as the term senile would lead us to infer, although they are undoubtedly most subject to it. It has been witnessed several times in children, and I have myself seen two cases of it before the age of twenty. It is often associated with fatty degeneration of the heart, arteries, liver, and other organs.

9. *Foreign Bodies*.—Foreign bodies are liable to pass into the cornea, and to bury themselves in its substance, where they soon become a source of irritation and inflammation. They are of various kinds, as

scales of iron, bits of glass, fragments of stone, and particles of coal. The extraneous substance may be lodged immediately beneath the epithelial investment of the cornea, or it may be impacted among its lamellæ, or, finally, it may perforate the cornea, one end sticking in the anterior chamber, and the other presenting externally. Great care is often necessary to detect the presence of the extraneous substance, especially when it is very minute, when it is composed of metal, or when it is situated immediately in front of the pupil, the black background of which has a tendency to obscure it, so as to prevent it from being easily seen. The best way to examine the part is to stand behind the patient, as he sits upon a chair fronting the window, and then, the lids being raised, making him move the eye about, in different directions, thus enabling the light to fall upon every point of its surface. In this manner no object, however minute, can possibly escape detection.

The removal of foreign bodies from the cornea requires more skill and tact than surgeons generally imagine. I have repeatedly had patients sent to me from a great distance, because the physicians in their neighborhood were unable to afford them the necessary relief, and that, too, when the case was of the most simple nature. When the eye is much inflamed, when the substance is buried at a considerable depth, or when the patient is a child, or a very nervous, irritable or excitable person, it will be well to exhibit ether before we proceed to the extraction, otherwise we shall be sure to experience serious annoyance. The upper lid being properly elevated, and the globe securely steadied by the finger, or, in the event of anæsthesia being employed, by a suitable hook, very much as in the operation for strabismus, a delicate cataract needle, or the point of a lancet, is insinuated around the foreign body, which is thus lifted out of its bed without any digging, a process which cannot be too carefully avoided, on account of its liability to be followed by severe inflammation and extensive opacity. A scale of iron that has been retained in the cornea for a few days is liable to become oxidized; hence, it may break under the instrument, and require to be extracted piecemeal. When the foreign body is firmly embedded in the layers of the cornea, the best plan will be to make an incision over it, to its full length, with a cataract knife, and then to dislodge it with a small needle. Should it have perforated the cornea in such a manner as to render it impossible to lay hold of it with the forceps, the puncture should be enlarged until this may be safely done, care being taken, if there be danger of the substance slipping back into the anterior chamber, to make counter pressure during the extraction by a delicate needle passed behind the cornea.

#### DISEASES AND INJURIES OF THE SCLEROTICA.

The sclerotica is liable to wounds, laceration, staphyloma and inflammation.

1. *Wounds*.—Wounds of the sclerotica may be of various kinds, as incised, punctured, and lacerated. They are, in general, easily recognized by their gaping appearance, caused by the retraction of their



edges, which is always proportionably great. If the sclerotica alone has been divided, the bottom of the wound will be formed by the surface of the choroid, and will, consequently, present a black appearance. If this membrane be also divided, there will probably be a sac-like protusion of the retina; and should the lesion embrace all the tunics, there will necessarily be an escape of more or less of the vitreous humor.

Incised wounds of the sclerotica readily unite by adhesive inflammation, the plasma which fills the gap becoming speedily organized and transformed into an analogous tissue. To promote this occurrence, both eyes should be subjected to the most perfect repose, for at least a week, by confining the lids with strips of isinglass plaster, as after the operation for cataract and artificial pupil. The patient remains in a dark room, purges himself well, and lives upon light food.

Laceration of this membrane may be caused by a blow of the fist, by the forcible contact of a stick, or by a fall upon the globe. What is remarkable, is, that the rupture usually occurs at a point opposite to that to which the violence has been applied, by a sort of *contre-coup*, or excessive distension of the fibres of the tunic. Hence, its most common site is either the upper or inner part of the sclerotica, where injury is seldom or never inflicted, the nose and superciliary ridge serving to shield it. The rupture may be limited to the sclerotica, or it may involve the other tunics; in which case it is liable to be attended with escape of the vitreous humor, and of the crystalline lens into the sub-conjunctival cellular tissue. The treatment is the same as in an ordinary incised wound. If the lens be dislocated, it should immediately be removed by a small incision, otherwise it may, by its pressure, interfere with the repair of the breach in the sclerotica.

2. *Staphyloma*.—Staphyloma of the sclerotica signifies a tumor formed by the protrusion of this membrane beyond its natural level. The exciting cause is usually an abnormal accumulation of aqueous humor in the posterior chamber of the eye, in consequence of the occlusion of the pupil, or of the attachment of the iris to the surface of the cornea. The pressure thus occasioned produces atrophy, and, finally, excessive attenuation of the sclerotica, followed by a separation of its fibres and the protrusion of the other membranes of the eye. The fact is the mode of formation is identical with that of the pouches which sometimes occur in the intestines and the urinary bladder, and which are so minutely described in most works on pathological anatomy. The affection is always accompanied by a discolored and disorganized condition of the inner structures of the eye. The size of the tumor varies from that of a currant to that of a hazelnut; it may be rounded or ovoidal in its shape, and has usually a bluish, purplish, or blackish appearance, from the presence of the coloring matter of the choroid. When the membrane is diseased at several points, there may be a corresponding number of protrusions, occurring either singly or in clusters. The annexed sketch (fig. 185) conveys an excellent idea of the situation, size, and shape of these tumors.

The *prognosis* of this affection is of the worst character; its very existence affords irrefragable evidence of incurable disease of the other structures of the eye; and hence it would be folly to subject the

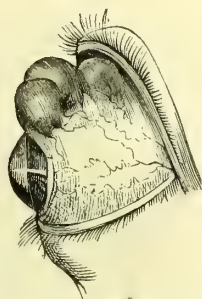
patient to treatment, except in so far as it may be designed to relieve deformity. With this object, the removal of the tumor may be attempted by snipping off the most prominent portion, trusting to shrinking for the disappearance of the remainder.

3. *Scleritis*.—Inflammation of the sclerótica seldom exists as a pure, uncomplicated affection; most commonly it arises during the progress of other ophthalmic diseases, especially corneitis and iritis. As an independent lesion, it may be induced by various causes, of which the principal are exposure to cold, a rheumatic or gouty state of the constitution, the action of the syphilitic poison, and the effects of mercurialization. It is most common in middle aged and elderly subjects, and winter and spring are its favorite periods of attack.

The *symptoms* of this disease are in general well marked. The pain is severe, throbbing, deep-seated, and liable to vesperal exacerbations; it usually extends to the forehead, temples, and upper part of the cheeks, and is aggravated by recumbency, and by the slightest motion of the eye, which feels full and tight, as if it were compressed by the hand. When the pain is less severe, the organ is sore and tender, or the seat of a distressing aching sensation. During the night, the suffering is often so excessive as to deprive the patient entirely of sleep, compelling him to sit up in bed, or walk the floor. In many cases there is hemi-crania, or a dull, heaving, aching pain in the side of the head, with great tenderness on pressure. In some cases, again, the pain is of a neuralgic character, recurring in regular paroxysms once or twice in the twenty-four hours. The eye is intolerant of light, the smallest quantity generally proving a source of extreme suffering; and there is always an abundant secretion of tears, though usually very little discharge of mucus, or of mucus and pus. Hence the edges of the lids do either not adhere at all, or only in a comparatively slight degree. If the eye be carefully inspected, it will be found that the discoloration is deep-seated, and of a faint bluish-pink, or lilac appearance, the vessels upon which it depends being exceedingly delicate, and disposed in parallel lines, converging towards the cornea (fig. 186), immediately behind which they are very numerous and conspicuous, forming a well-marked zone around its periphery.

The disease, in its earlier stages, is in great degree, if not exclusively, limited to the sclerótica; in a short time, however, it involves the other structures, especially the conjunctiva, cornea, and iris (fig. 187). When this is the case, the ball of the eye often exhibits a bloodshot appearance; there is more or less haziness of the cornea, with an enlargement of its vessels; the pupil is sluggish, or entirely immovable, and the surface of the iris is altered in its color. The lids are

Fig. 185.



Staphyloma of the sclerotic coat, seen in profile.

Fig. 186.

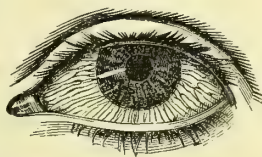
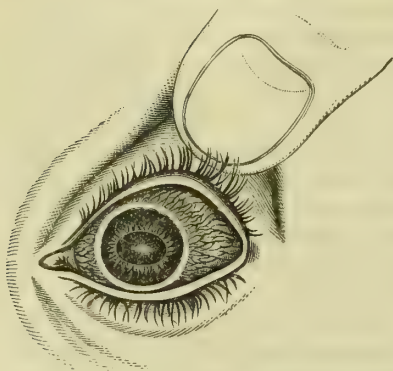


Fig. 187.



Scleritis extending to the internal tunics.

rarely, under any circumstances, materially involved in the morbid action. Much diversity obtains in regard to the state of the constitution; in many cases there is an entire absence of fever, while in others it may be present from the beginning, and constitute one of the most prominent symptoms.

The *diagnosis* of scleritis is sufficiently easy, particularly in the earlier stages of the disease. The history of the case, the character and intensity of the pain, the excessive lachrymation and intolerance of light, and the peculiar nature

of the vascularity of the affected membrane, cannot fail to enable the practitioner to distinguish it from other ophthalmic affections. In conjunctivitis, the discoloration is superficial, and of a scarlet hue; in scleritis, it is deep-seated, and of a pale pink, bluish, or lilac tint; in the former, the vessels are very large and arranged arborescently; in the latter, extremely small, almost hair-like, and disposed in straight, parallel lines, extending from behind forwards towards the cornea. Finally, in conjunctivitis, the vessels are movable; in scleritis, on the contrary, they are fixed.

In the *treatment* of this malady, the practitioner must be influenced by the nature of the exciting cause, and the actual condition of the system. The milder, non-specific forms of the disease will generally readily yield to active purgatives, light diet, and diaphoretics, particularly Dover's powder, or antimony and morphia, with cupping or leeching of the temple. If the patient be plethoric, and the inflammation very severe, blood should be taken freely from the arm, and the system be kept constantly under the influence of the saline and antimonial mixture, with calomel and an anodyne at night, to act upon the secretions, and to promote sleep.

In *rheumatic* scleritis, the best remedies are colchicum and morphia, given in full doses early in the evening, and in small doses several times during the day. My usual practice is to administer a drachm of the wine of colchicum, towards bedtime, along with a grain of morphia, using a hot and slightly stimulating foot-bath immediately after, so as to get the patient, if possible, into a copious sweat. The next morning, about ten o'clock, half the quantity of these articles is given, or the dose may be still smaller, according to the tolerance of the system.

*Syphilitic* scleritis must be treated with calomel and opium, or some other form of mercury, carried to gentle ptyalism; or, what will usually be found to answer better, the iodide of potassium, in doses of from ten to twenty grains three times a day, combined with an anodyne, especially towards bedtime. A similar plan will be called for when the disease has arisen from the inordinate use of mercury; in



this case, indeed, gentle ptyalism is generally an indispensable element in the treatment.

Anodyne liniments, embrocations, and unguents, applied freely to the forehead, cheek, and temple, are often of great benefit in sclerotitis, however induced; the use of medicated steam, directed upon these parts, will also be found very agreeable and soothing. In most cases, it will be necessary to take blood from the neighborhood of the inflamed organ by cups or leeches. As to counter-irritation, in all its forms, I am generally averse to it, for the reason that I have usually seen it do harm instead of good. This is especially true when it is applied to the temple, behind the ears, or even to the nape of the neck. It is less objectionable when applied to the arm, but even then it often fails to be of any material use in removing the morbid action.

When sclerotitis becomes chronic, a mild course of alterants and tonics will be necessary, aided by a properly regulated diet, tepid bathing, and change of air.

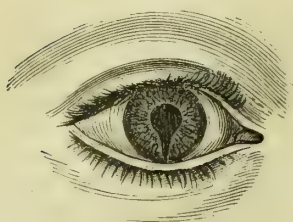
#### DISEASES AND INJURIES OF THE IRIS.

The iris is liable to various accidents and diseases, of which the most common and important are, wounds, inflammation, prolapse, and morbid adhesions. I am not aware that it is ever the seat of any of the heterologous formations. The inflammation which assails it may be of the common kind, although this is exceedingly rare, or it may be caused by a rheumatic, syphilitic, or strumous state of the system. Finally, the iris is often the seat of interesting and delicate operations, rendered necessary on account either of its own diseases or of diseases of the cornea, obstructing vision.

1. *Congenital Vices*.—The iris is subject to congenital malformations, of which the most common are absence of the membrane, and irregularity of the pupil. The former of these defects, which has been termed *irideremia*, is necessarily attended with very imperfect vision, the eye, in ordinary light, being constantly dazzled by objects, and disposed to roll about. In the only instance that I have ever seen of it, the child was nearly blind, and the interior of the globe, instead of being of a reddish tint, as usually represented by authors, was remarkably black. In some of these cases the iris is not completely absent, but exists in a rudimentary state, forming a narrow ring at the periphery of the cornea.

In a case of malformation which I saw not long ago, the pupil had the appearance of being double. It occurred in a man, aged twenty-eight, whose sight was perfect, although both eyes were in precisely the same condition. The pupil, which readily obeyed the light, was situated nearer the inner than the outer side of the globe, and occupied the inferior portion of the iris, extending down to the margin of the cornea. The more common variety is represented in the annexed sketch (fig. 188). The defect is called *coloboma*. The fissure is of a triangular shape, the apex extending downwards towards the ciliary margin of the iris. In rare cases, the pupil, although well formed, has been found to be situated out of its usual place.

Fig. 188.



Congenital fissure.

2. *Wounds*.—Wounds of the iris are inflicted either designedly, as in the attempt to form an artificial pupil, or accidentally, as in the operation for cataract, and under other circumstances. The chief interest which such lesions possess is that they are seldom productive of serious inflammation, although the plastic matter that is poured out is very apt to cause morbid adhesions, interfering more or less with vision. Sometimes the iris is torn off from its ciliary attachments by a blow or fall, leading thus to the formation of a species of artificial pupil; the opening, even if comparatively small, never closes; while, if it be at all large, it will seriously encroach upon the natural one, diminishing its size, changing its form, and crippling its action. Whatever the character of the injury may be, the treatment must be strictly antiphlogistic, it being of the greatest importance that the resulting inflammation should be subdued as promptly as possible. If there be any plastic deposit, mercury, carried to slight pytalism, will be required.

3. *Inflammation*.—Iritis is a much more frequent affection than is generally supposed. From what I have seen of the diseases of the eye, in private and hospital practice, I am persuaded that it is very often entirely overlooked, the malady under which the patient labors being mistaken for inflammation of the conjunctiva and sclerótica. That this should be so is not surprising when we reflect upon the fact that iritis altogether escaped the attention of practitioners until the commencement of the present century. Now, however, that its characters are so well understood, there is really no excuse for errors of diagnosis. With a little attention on the part of the medical attendant, it is as easily recognized as a boil upon the nose, a sty on the eyelid, or a wart on the finger.

Iritis may proceed from a considerable variety of *causes*, of which the most important are, external injury, exposure to intense light, suppression of the cutaneous perspiration, a strumous, gouty, or rheumatic state of the constitution, and the operation of the syphilitic virus. It often begins as a primary affection; but in many cases it is altogether of secondary origin, being the result of an extension of disease from the surrounding tissues. Finally, it may be acute or chronic, and occur in both sexes, in every class of individuals, and at all periods of life, even in very young children. When it attacks the latter, as an independent affection, the probability is that it is owing to a syphilitic taint of the system, although this is by no means necessarily the case.

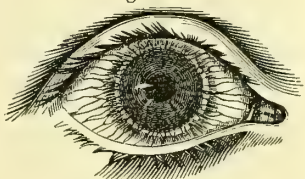
The disease frequently begins in a very insidious manner, and hence great and irreparable mischief is sometimes done before the practitioner is made aware of the nature of the case. Such an occurrence is the more likely to happen because there is often an entire absence of the more ordinary phenomena of ophthalmia, especially discoloration of the superficial tunics, and also everything like severe local suffering,

calculated to arouse attention. In general, however, pain is an early and prominent symptom, or, if it is not, it is sure soon to become so; lachrymation and intolerance of light are also well marked. Unless the inflammation involves the conjunctiva, the disease may go on through its different stages, and even ultimately destroy the sight completely, and yet not occasion any considerable redness. In general, the discoloration is limited, at least in great degree, to the sclerotica, at the anterior extremity of which there is always a distinct zone (fig. 189), formed by the vessels of the fibrous coat as they dip down into the eye, to anastomose with those of the iris and choroid. This zone, which is never absent, is at first of a faint rose color, but afterwards, when the inflammation is fully established, of a deep red, cinnamon, or brick hue. At the beginning of the disease there is a narrow ring of white between it and the cornea, but as the morbid action advances this is gradually lost, by an extension of the vascularity. The vessels which produce the zone have a fine hair-like appearance, with a radiated arrangement, and are seated beneath the conjunctiva, in the substance of the sclerotica, in which they are immovably fixed (fig. 190). When the disease has made considerable progress, the peculiarity of this vascularity is lost, by reason of the excessive discoloration of the conjunctiva; and it should not be forgotten, as was previously intimated, that, in complicated cases, or in secondary forms of iritis, it may be completely masked even at the beginning of the attack.

The *pain* of iritis varies; in general it is very severe and distressing, but I have seen cases, even of a very bad character, as it respected the state of the sight, where it was absolutely absent, from first to last. Such cases are, of course, exceptional. Usually the pain is deep-seated, beginning apparently in the orbit, and rapidly involving the globe; becoming more and more severe and constant as the disease progresses; subject to violent nocturnal exacerbations; and generally, especially in the more confirmed stages of iritis, extending to the surrounding parts, particularly the temple, eyebrow, and cheek. Sometimes there is the most violent hemisideria.

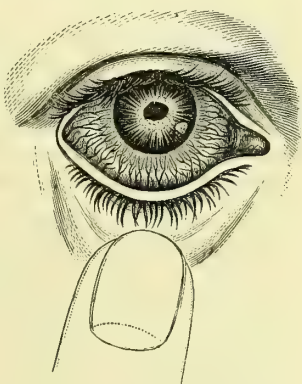
The iris itself experiences most important alterations. Even at an early stage of the disease it is already quite sluggish, while somewhat later it is entirely insensible to every kind of stimulant, however strong or long continued. Its anterior surface loses its smooth, shining,

Fig. 189.



Acute iritis.

Fig. 190.



Iritis; showing the characteristic vascularity of the globe, the iris being clogged with lymph, and the pupil contracted and irregular.



fibrous appearance, and becomes rough, puckered, and dull; the pupil diminishes in size, and is ultimately almost obliterated, being, perhaps, hardly as large as a pin-hole; at the same time it is observed to be deformed, and adherent to the capsule of the lens. In addition to these characteristics, there is an extraordinary change in the color of the iris, contrasting strikingly with that of the healthy membrane, and evidently dependent upon the injected condition of the proper tissues of the part, with a slight effusion of blood, or blood and lymph. The morbid hue, usually somewhat reddish, or of a dusky brick, is most conspicuous when the iris is bluish; less so, when it is brownish or hazel. Finally, the iris is often preternaturally convex, especially towards its circumference; the pupillary margin is greatly thickened; the aqueous humor is augmented in quantity, and rendered more or less turbid; and masses of lymph are frequently observed in the anterior chamber, either loose, or adherent to the diseased membrane.

When the malady is fully developed, the sight is either much impaired, or completely destroyed; for not only is the pupil greatly contracted, so as to interfere materially with the transmission of light, but there is often opacity of the cornea, cataract of the lens and its capsule, and a disorganized state of the retina and choroid, as is evinced by the frequent attacks of coruscations and other symptoms of deep-seated disease. Fever, often of a high grade, attends the earlier stages of iritis.

The *diagnosis* between ordinary iritis and iritis dependent upon rheumatism and syphilis, is often extremely obscure, and, therefore, difficult of determination. This, however, is the less to be regretted because the treatment is essentially the same, whatever may be the exciting cause. The distinction between the rheumatic and syphilitic forms will be best understood by the subjoined tabular arrangement:—

#### RHEUMATIC IRITIS.

1. Usually coexists with rheumatism or gout.
2. Most common in elderly subjects.
3. Often only one eye suffers.
4. The zone around the cornea is of a dull, rusty red, with a white ring in front.
5. There is little or no lymph in the anterior chamber and upon the anterior surface of the iris.
6. The aqueous humor is usually clear, or nearly so.
7. The pain is nearly constant, though liable to exacerbations, especially at night.

#### SYPHILITIC IRITIS.

1. With papular eruptions, sore throat, and other evidences of syphilis.
2. May occur at any age, even in infancy.
3. Generally both eyes are affected; first one, and soon after the other.
4. Is of a cinnamon or brownish hue, and soon extends quite up to the cornea.
5. The plastic deposits are always prominent, often presenting themselves in the form of little, fleecy, vascular, reddish-looking tubercles, attached to the surface of the iris.
6. Generally turbid, often highly so, and very albuminous.
7. Very bad at night, but almost, if not entirely, absent during the day.

The *prognosis* of iritis may be gathered from what precedes. Whenever the disease is of long standing, or severe in degree, little hope need be entertained of ultimate recovery. The patient, it is true, may be able to discern light, and perhaps grope his way, but, as it respects useful vision, he will not be likely to get any; for it may confidently be asserted that there is no form of inflammation, which, if allowed to

progress, is more certain to damage the deep structures of the eye, than iritis, especially the rheumatic and syphilitic varieties.

The *treatment* of iritis is conducted upon the same principles which govern the practitioner in the management of ophthalmic diseases generally. Blood is taken freely from the arm, if the patient is plethoric, and, under almost any circumstances, by cupping and leeching from the temples. The bowels are thoroughly evacuated by efficient purgatives, as calomel and jalap, or senna and salts, the action of the heart is controlled by the antimonial and saline mixture, and pain is allayed by the liberal use of anodynes. In the rheumatic form of the disease, colchicum proves a valuable adjuvant. But the great remedy in iritis, in all cases, excepting, perhaps, the most simple, is mercury, carried, to the extent of rapid ptyalism. For this purpose the medicine should be given in full doses, its effects, however, being carefully watched, lest profuse salivation should arise. The best article is calomel, in doses of from two to three grains every four or six hours, properly guarded with opium, and continued until the gums become tender, when it must be either withheld or administered in smaller quantities. When the calomel is tardy in its action, it may be assisted by mercurial inunctions; for, as already hinted, the object is to make as speedy an impression as possible upon the disease, in the hope of preventing its direful effects upon the pupil and lens, the integrity of which is so important to the preservation of the sight, and which is always so much endangered by neglect and ill management. It is true that ptyalism is not at all essential to the success of the treatment, for it has been shown that the inflammation often vanishes where, although the article is freely employed, no such effect follows its administration; but the occurrence is always anxiously looked for because it serves to assure us that the medicine is doing its duty.

It is not necessary here to inquire into the mode of operation of mercury in iritis. The disease derives its chief importance, as far as the danger is concerned, from the fact that it is attended with an effusion of plastic matter, not only into the proper substance of the membrane, but upon its surfaces and also into the chambers of the eye, embarrassing the movements of the iris, plugging up the pupil, and causing adhesions between the affected structure and the capsule of the lens. Now, the object in administering mercury is to prevent the deposition of this substance, and to promote the absorption of that which has already taken place, and that it is well calculated to do this, experience has abundantly established, although we cannot explain the precise mode of its operation. Mercury, then, is the great remedy in this disease, the remedy *par excellence*, and should be given early and freely, until it has effected the object for which it is exhibited. Its action is less apparent in the traumatic forms of iritis than in the rheumatic and syphilitic, in which it is absolutely indispensable.

The effects of the remedies here mentioned may be aided by counter-irritation by blisters, croton oil, or tartar-emetic ointment behind the ears or to the nape of the neck; but all direct applications should be dispensed with, except such as are of the most soothing character, as the steam of hot water and opium, fomentations, and light, emollient,

and medicated poultices. The circumorbital pains are often abated by anodyne embrocations, lotions, and unguents.

Much stress has been laid by authors upon the propriety of keeping the pupil well dilated with atropia during the progress of this disease. While every one must perceive the force of the injunction, the misfortune is that atropia does not possess this property, nor is there, so far as is at present known, any article that does. The moment the iris is actively inflamed, that moment it ceases to be influenced by narcotic applications; the pupil contracts, and no stimulus, however powerful, can afterwards excite it.

I have no experience with the use of turpentine in the treatment of this disease; I have, however, given it in several instances, apparently quite favorable for the appropriate action of the remedy, and I have not been able to satisfy myself that it has been of any benefit. In the syphilitic variety of the complaint, iodide of potassium may advantageously be exhibited, to aid in completing the cure, after we have made fair trial of mercury. In debilitated persons, in chronic cases, and in the latter stages of the acute attack, tonics may be demanded.

4. *Prolapse*.—Prolapse of the iris may depend upon three circumstances, namely, wound, ulceration, and sloughing of the cornea, and may present itself in two varieties of form, the partial and the complete, of which the former is by far the more common. Indeed, complete protrusion of the membrane can only occur when there is most extensive injury of the anterior portion of the ball. Partial prolapse is usually caused by ulceration of the cornea, attended with perforation of all its lamellæ. The opening thus made is immediately followed by an escape of the aqueous humor, with protrusion of the iris, by which the gap is effectually closed, and further mischief prevented. Plastic matter being effused, the prolapsed portion contracts adhesions to the edges of the ulcer, the site of which is afterwards indicated by a black spot with a slight peripheral opacity. From the manner in which the iris is dragged out of its normal position, the pupil, except in the milder varieties of the accident, undergoes important changes in its form, size, and situation, attended with corresponding alterations of sight. When the displacement is considerable, vision may be completely destroyed.

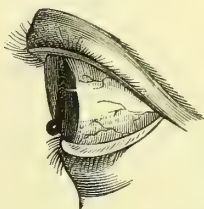
The *treatment* of this affection must be regulated by circumstances, it being impossible to lay down any particular plan for the guidance of the surgeon. In complete prolapse, depending upon extensive destruction of the cornea, the case is, of course, hopeless; if, on the other hand, it is caused by wound, the membrane should immediately be replaced by means of a probe, and the lids kept well closed with adhesive strips, until the parts have become thoroughly united. The success of the treatment will be greatly influenced by the care with which the operation of replacement is performed; if the patient be a child, quietude should always be insured by the administration of anæsthetics, as it will hardly be possible to execute the procedure in a satisfactory manner without this precaution. The after-treatment is, of course, conducted upon strictly antiphlogistic principles.

When the prolapse is the effect of ulcerative perforation of the



cornea, our hands are equally tied, as in the complete form of the affection. To push back the iris, under such circumstances, would only lead to worse results; instead of this, therefore, the part is allowed to keep its place, for it is nature's plug, and is absolutely necessary to close the artificial opening, however much it may impair vision. This variety of prolapse is well illustrated in the adjoining cut (fig. 191). The protruded part projects beyond the level of the cornea, looking somewhat like the head of a small fly; whence the term *myocephalon*, applied to it by professed oculists. When the iris protrudes through several apertures, it may give the surface of the cornea a black, tuberculated aspect, and may require retrenchment, in order to prevent injurious friction of the lids.

Fig. 191.



Prolapse of the iris.

In the treatment of recent prolapse, dependent upon wound of the cornea, free use should be made of belladonna, or atropia, with a view of bringing the iris as speedily as possible under the full influence of the remedy. By dilating the pupil, the membrane is drawn away from the cornea, and is, therefore, less likely to be permanently intercepted by the edges of the wound.

*Synechia* is the name given to an abnormal adhesion of the iris to the cornea and capsule of the lens, the term anterior being added to designate the former, and posterior to signify the latter. Anterior synechia is caused by wound, ulceration, or sloughing of the cornea; posterior, by iritis, and other diseases, attended with plastic deposits. The lesion, in whatever form it may present itself, is always attended with impairment of vision, and occasionally with total blindness. Posterior synechia is often complicated with cataract. When the cornea and lens preserve their transparency, and the pupil is not completely obliterated, sight may sometimes be improved through the agency of belladonna, and at other times, by operation, the nature of which must be regulated by the character of the concomitant lesion.

5. *Obliteration of the Pupil*.—Obliteration of the pupil may be caused by symptomatic disease of the eye, or of the general system; by loss of power in the muscular fibres of the iris in consequence of interstitial deposits; or by the presence of plastic matter, filling up its aperture, either as an amorphous substance, or as an adventitious membrane, adherent to its edges. In the latter case, the affection constitutes what is termed a false cataract.

The treatment must be regulated by the exigencies of the case; by attention to the general health, when that is obviously at fault; by the removal of ophthalmic trouble, as when the affection is symptomatic; by the use of atropia, and by operation. When the iris is not adherent, a very useful degree of vision may sometimes be obtained by permanent artificial dilatation by means of atropia. Operation is indicated when the obliteration is dependent upon the presence of organized lymph, and may be executed either with a delicate needle, introduced through the cornea, as in the anterior operation for cataract, or with a cataract knife, as in the operation of extraction. Finally,

when other means are unavailing, an artificial pupil may be formed, although the success of this is not by any means always, or, perhaps, even generally, certain.

#### ARTIFICIAL PUPIL.

The establishment of an artificial pupil, by which is meant a new opening for the transmission of light, may be rendered necessary by various causes, besides those mentioned in the foregoing paragraphs. Thus, although the natural pupil may be perfectly healthy, yet there may be such an amount of corneal opacity as to cause complete blindness. This, indeed, is one of the most frequent reasons for this operation; for, as already stated, the other causes of blindness occasionally admit of relief by other means.

The operation for artificial pupil demands extraordinary skill for its successful execution, and should, therefore, never be attempted by any one who does not possess the requisite accomplishments. Besides, it should not be undertaken unless there is at least a fair prospect of success. Some preliminary treatment is usually necessary, just as in the operation for cataract; and we should be fully satisfied that the internal structures of the eye have not been destroyed by pre-existing disease, otherwise, even if we succeed, vision will not be at all improved. As a general rule, it is proper not to interfere if the patient has no longer any perception of light; or, if there is marked evidence of former iritis, of a dissolved condition of the vitreous humor, or of serious organic lesion of the retina, or of the retina and choroid. Finally, no operation should be performed until the eye has completely recovered from the effects of the morbid action, creating a necessity for it.

Various plans have been devised and practised for the establishment of an artificial pupil, but, as far as it respects their utility, they may all be referred to three principal classes, namely, incision, detachment, and excision. Whenever it is practicable, the new aperture should occupy the site of the old, or, at all events, be as close to it as possible, because the nearer it is to the natural axis of vision the more likely will it be to answer the object; under opposite circumstances, it should be placed towards the inferior part of the iris, or towards the inferior and external part. Unless the condition of the eye renders it absolutely necessary, we should never make the opening above, as it will be constantly interfered with by the lid. Some surgeons prefer the nasal side of the iris, but this has certainly no appreciable advantages over the other situations just pointed out.

In regard to the size and shape of the pupil, no definite rules can be given. An opening, such as the iris presents in ordinary vision, in a clear, but not too bright a light, will be quite large enough, and when this is the case, it does not matter particularly what shape it has, whether it is circular or angular, although the former will certainly be the more seemly.

The instruments required for the operation are delicate scissors, a cornea-knife, an iris-knife, and two hooks, one sharp and the other blunt.

The scissors are curved on the edge, and are provided with exceedingly slender blades, one of which is probe-pointed and longer than the other, which is sharp, and when the instrument is shut, completely shielded by its fellow. The handles are long, and furnished each with a large ring so as to command a firm grasp. A good idea of this instrument is conveyed by the annexed sketch (fig. 192). I have never had occasion to use the canula-scissors, invented by Mr. Wilde, of Dublin, for making an artificial pupil, and, although it is a very ingenious instrument, it is difficult to perceive of what use it can be in such an operation, seeing how very difficult it is to expand and move its blades. The cornea may readily be divided with any delicate cataract knife.

The hooks (figs. 193, 194) which are usually employed in this operation are extremely delicate, and shaped in such a manner as to enable the operator to retain a firm hold upon the iris. The sharp hook is usually objected to, on the ground that it is liable to endanger the lens, but with a little care everything of this kind may effectually be avoided.

1. The operation by *incision* is usually performed with a very delicate knife, or needle, with a double cutting edge (fig. 195), introduced

Fig. 192.

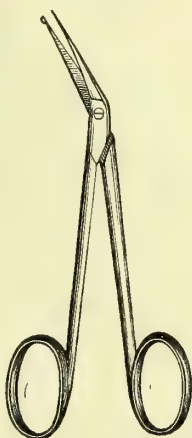


Fig. 193. Fig. 194.

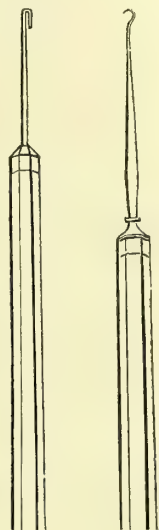
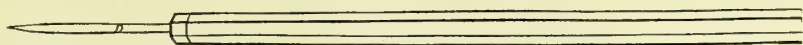


Fig. 195.



through the sclerotica, at the usual place of entrance in the operation for cataract. The instrument having pierced the iris, at the point of election, is carried across the anterior chamber, so as to divide, either horizontally or vertically, and by a sort of sawing motion, the membrane in one-third of its extent, as represented in fig. 196. The knife must be extremely sharp, otherwise great difficulty will be experienced in making the aperture of the requisite dimensions. The success depends upon the amount of contraction of the muscular fibres of the iris; when this power is lost, as it often is after violent inflammation, the edges of the wound will not only not recede, but speedily reunite, and thus effectually frustrate the intention of the surgeon. The same process is, therefore, obliged to be repeated, perhaps a number of times, and even then the result may be very unsatisfactory. For this

Fig. 196.





reason, as well as because the operation always necessarily endangers the integrity of the lens, it has become nearly obsolete, although it cannot be denied that it now and then succeeds most beautifully, as it has done several times in my own hands.

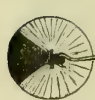
Another mode of performing this operation, one that is altogether preferable, because more certain in its execution and more satisfactory in its results, is to divide the cornea with a common cataract knife, to the extent of about three lines, and then cut through the iris with a smaller instrument.

2. The operation by *detachment* (fig. 197) consists in tearing away a portion of the iris from its ciliary connections; it is adapted chiefly to cases of great central opacity, and is never performed as a matter of choice, but as one entirely of necessity. For reasons already mentioned, the artificial opening is never, if possible, placed at the upper margin of the iris. The operation is executed with a small cataract needle,



curved rather abruptly at the point, which, being passed through the cornea, near its junction with the sclerotica, is pushed across the anterior chamber, and inserted into the periphery of the

Fig. 198.



iris, which is then carefully separated from its attachments to the extent of at least two lines. Great care must be taken to make the aperture larger than in the central operation, for, as the pupil is not in the line of the natural

axis of vision, it will require a much greater number of rays of light to produce useful sight. Or, instead of the above operation, a small opening is made into the cornea, and a portion of the detached iris is drawn out by means of a hook (fig. 198), between its edges, where it is permanently retained.

3. The most unexceptionable procedure, however, of all is *excision*; it is indeed almost the only one that should be performed when we can have our choice, as it neither endangers the lens, nor is followed by closure of the artificial aperture. The cornea is divided as in the preceding case, when, if the pupil be not effaced, a blunt hook is passed round its margin, which is then drawn down and snipped off with the scissors; or, instead of this, the iris is brought down with a sharp hook, and a piece excised; or, finally, the membrane is seized as just stated, and a portion cut out with a pair of sharp-pointed scissors. Sometimes the iris protrudes as soon as the knife has left the cornea; when this is the case the procedure is greatly simplified, as the required flap may be removed without introducing any instruments into the anterior chamber. In performing this operation, a great deal of care is necessary, lest we wound the lens, and thus provoke the formation of cataract.

Occasionally the cornea and iris are simultaneously divided, especially when there is permanent occlusion of the pupil (fig. 199). The requisite portion of the iris is then removed with the hook and scissors.

A knowledge of the operations now described will enable the young surgeon to make such modifications as the various exigencies of the cases he may meet with in practice may call for. To attempt to give even an outline of these modifications here would be as tiresome as it would be useless. The whole subject of artificial pupil has been treated by the specialists in the most weary and cumbersome manner, well calculated to disgust any sensible man with a branch of operative surgery which, if properly simplified, could be made one of the most delightful, useful, and fascinating that could possibly engage attention. The fundamental principles being thoroughly understood, the details of each particular case must necessarily be left to the judgment of the surgeon.

The *after-treatment* is extremely simple, strongly resembling that of cataract. Both eyes are carefully closed by strips of isinglass plaster, and a grain of morphia is given the moment the patient is placed in bed, to insure the repose of the affected organ. The light is carefully excluded from the room, and the diet is strictly farinaceous for at least a week, when, especially if the person be old, or rather feeble, a little tender meat may be allowed, or, if preferred, a glass of porter. The dressings are taken off at the end of the third day to be renewed, and kept on, if necessary, for some time longer. Exposure to light must be very gradual, for the eye remains long weak and predisposed to inflammation.

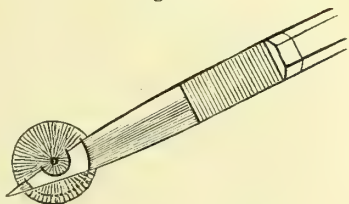
#### DISEASES OF THE CHAMBERS OF THE EYE.

The only affections of the chambers of the eye requiring any special notice are dropsical accumulations, effusions of blood, and the development of hydatids.

1. A morbid accumulation of water, constituting what is called *hydrophthalmia*, may exist simultaneously in both chambers or be confined to one, more commonly the anterior. Dropsy of the anterior chamber is usually caused by inflammation of the membrane of Demours, a serous structure lining the cornea and the iris, both of which become more or less changed during the progress of the disease, the former being always abnormally prominent, and often somewhat nebulous, the latter dull and lustreless, with the pupil in a motionless and rather dilated condition. The ball is very hard in the earlier stages of the affection, but as the dropsy advances, it generally becomes very soft, and fluctuates distinctly under pressure. The patient, experiencing a sense of distension, but no pain, is annoyed by deceptive vision, and gradually loses his sight, which is occasionally completely destroyed. The disease is sometimes congenital, or, at all events, arises soon after birth.

In posterior hydrophthalmia, there is always, or nearly always, a dissolved state of the vitreous humor; the eye is very large, hard, painful,

Fig. 199.



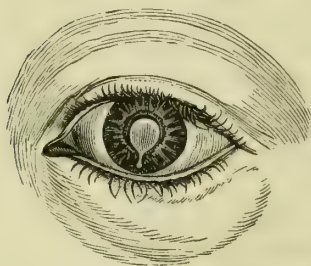
and moved with difficulty; the sight progressively diminishes; the iris is pushed forwards into the anterior chamber; and the patient ultimately becomes completely blind. Of the causes of this form of dropsy nothing is known.

The *prognosis* in hydrophthalmia is extremely unfavorable, especially in the posterior variety. An attempt may be made at relief by frictions around the eye with mercurial ointment, and the use of minute doses of calomel, with an occasional hydragogue cathartic, counter-irritation behind the ears, and repeated evacuation of the fluid by means of a small puncture of the cornea. Rational, however, as this treatment apparently is, I have rarely derived any essential benefit from it.

2. In consequence of external violence, as a blow upon the ball, or surgical operations, or spontaneous rupture of some of its vessels, an effusion of *blood* occasionally takes place into the chambers of the eye. In the female, it has been observed to occur as an effect of amenorrhœa, and in both sexes as a symptom of a scorbutic state of the system, attended with hemorrhage in other parts of the body. The fluid usually disappears in a short time by absorption; when the quantity, however, is inordinate, it may prove a source of irritation by its pressure upon the iris and cornea, and should then be evacuated by a small puncture through the latter membrane.

3. A species of *hydatid*, the cellular cysticerce of naturalists, has been met with, in a few rare instances, in the anterior chamber, floating about in the aqueous humor. It has hitherto been observed exclu-

Fig. 200.



Cellular hydatid.

sively in young subjects, mostly under fourteen years of age, without any apparent cause. The animal is about the sixth of an inch in diameter, and, as seen through the cornea, looks, when fully unfolded, very much like a miniature balloon (fig. 200), being semi-transparent, and often quite brisk in its movements, retracting and protruding its head and body at pleasure. The consequence of the presence of such a body in the anterior chamber must, necessarily, be more or less impairment of vision, with a ten-

dency to excite inflammation in the inclosing structures. On this account, it should be promptly removed by an incision through the cornea, the patient being under the influence of anæsthesia.

## DISEASES AND INJURIES OF THE CRYSTALLINE LENS AND ITS CAPSULE.

### CATARACT.

Cataract may be defined to be an opacity of the crystalline lens, or of its capsule, or of both. In the first case it is called lenticular cataract, in the second, capsular, and in the last, capsulo-lenticular. These distinctions are of great practical moment, as they exert an important influence



upon the operations which are required for their cure. There is another variety of the disease described by writers as cataract of the liquor of Morgagni, a fluid which is interposed between the lens and its capsule, and which occasionally assumes a milky appearance. Of the existence of this affection, as a distinct lesion, I entertain great doubt. Cataract may be single or double; simple or complicated; traumatic or idiopathic; recent or old; mature or immature. The import of these terms is so evident as not to require explanation.

Of these different forms of cataract, the capsulo-lenticular is the most common; but of its relative frequency we have no knowledge. My own conviction is that both the others are very rare, from the fact that one of these structures cannot be diseased for any length of time, or to any considerable extent, without the other participating in the morbid action. I presume, indeed, that, whenever the capsule is at all seriously affected, the lens must also speedily suffer, although the converse of this statement may not be true; cases occasionally occurring where the lens is completely opaque, and yet the capsule retains its transparency.

Cataract is a very common disease, and is liable to occur at all periods of life, from the moment of birth to the most profound decrepitude. Indeed, there is reason to believe, that it occasionally exists as an intra-uterine disease. Although it may show itself at any age, yet experience has proved that the greatest number of cases are met after the fiftieth year, or between that period and sixty-five. Many cases also occur between the fortieth and fiftieth year. Young persons are comparatively exempt from it. The number of cases among children is considerable; most of those that I have witnessed were either congenital, or they arose within the first few months after birth. The disease sometimes occurs in every member of the same family, as in a case mentioned to me by the late Professor Drake, where as many as six children suffered in this way. Twelve years ago, a man brought to me three of his children, two sons and a daughter, on account of double cataract. Of his other six children, three were affected with strabismus. In another family, concerning which I was consulted more recently, four children out of six were the subjects of this disease, two having been affected with it from birth. Dr. Thomas J. Kennedy, of Tennessee, communicated to me, in 1842, the particulars of a family consisting of six children, of whom three had congenital cataract. Of these, two were idiotic, besides which one of them labored under hare-lip and cleft palate. Occasionally, again, the affection would seem to be hereditary, cases occurring in parents and their offspring for several successive generations.

Males are more frequently affected with cataract than females; but in what ratio has not been determined. The probability is that the number of cases would be nearly, if not quite, alike in both sexes, if both were equally exposed to the exciting causes of the disease; for it can hardly be supposed that the difference depends upon any other circumstance; certainly not, so far at least as we can perceive, upon any difference in the organization of the eye.

*Causes.*—Of the causes of cataract very little is known with any de-

gree of certainty. My own belief has long been that the disease is generally developed under the influence of inflammation, leading to a deposition of fibrin, or of fibrin and serum, into the substance of the lens and its capsule. It is in this way only that we can account for the opacity which takes place in these structures, and upon which the disease in question essentially depends. When cataract forms very rapidly, it is probable that these parts are struck with a species of senile gangrene, in consequence of obstruction of the central artery of the retina, thus cutting off the supply of blood, and producing a change of nutrition. What lends support to this view is the fact that opacity of the lens occasionally exists, without any disease apparently of its capsule, whereas, disease of the capsule, especially of its posterior segment, is always promptly followed by a change of color of the inclosed structure. Now, it is well known, that the capsule of the lens receives the ramifications of the central artery of the retina; and, although we are not able to trace any of its branches into the lens itself, yet it is reasonable to suppose that some of them pass into its substance. If we assume this to be the case, as, I think we may, it is only necessary to imagine that these vessels are in a state of disease, and we will have an easy explanation of the formation of cataract. When once the vascular connection of the lens and its capsule is destroyed, opacity is inevitable. Of this occurrence we frequently see examples in injuries of the eye, attended with lesion or displacement of the lens, which are invariably followed by cataract, and that generally in a few hours. In old people, in whom cataract is so very common, the disease is probably the result of a species of atrophy, dependent upon a gradual diminution of the supply of blood, and ultimately complete arrest of the circulation.

However we may explain the manner of its formation, cataract generally comes on without any assignable cause, the subjects of it being often in the most perfect health at the time of its appearance, as well as during its subsequent progress. Sometimes, but this is rare, it is traceable to the effects of external violence, as a blow upon the eye, or injury upon the head. Wounds of the lens and its capsule, whether incised, punctured, or lacerated, are, as was before stated, always followed by cataract. Violent ophthalmia, especially when it involves the deeper structures of the eye, frequently leads to this disease, along with some of its worst complications.

There are certain circumstances which are generally regarded, though, perhaps, not with sufficient reason, as so many predisposing causes of cataract. Thus, it is said that cooks, blacksmiths, foundrymen, and persons of other kindred pursuits, are particularly prone to the disease. It is also supposed that seamstresses, watchmakers, and other artists, whose eyes are constantly upon the stretch in viewing minute objects, are unusually liable to suffer from cataract. Without wishing to assert that these statements are wholly untrue, I have no hesitation in declaring that I have seen nothing in my own practice to countenance them. Most of the cases of cataract that have fallen under my observation have occurred among farmers, mechanics, physicians, lawyers, and divines, who never injured themselves in this way, nor, so far as I could ascertain, in any other. Besides, the disease

often occurs in infants and young children, at an age when such exposure is impossible. I have never had a case of cataract in a watchmaker, in a foundryman, or even in a literary man who sat up late at night by the flame of his lamp or gas-burner. I believe, therefore, that many of what are considered as predisposing causes of cataract, exert no such influence, or only in a very remote degree. Of the effect of temperament upon the production of this disease we are totally ignorant; all that has been written respecting it is purely conjectural.

Cataract generally forms in a very slow and gradual manner, several months usually elapsing from the time it becomes first apparent until it exhibits the characteristics of maturity. Occasionally, however, it is developed with great rapidity, altogether out of the ordinary course, as in a few hours, a night, or a day. A case in which a cataract seemed to have been formed in less than twenty-four hours was shown to me in 1855, by Dr. John Bartlett, in the surgical ward of the Louisville Hospital, in an old man, a gardener by occupation. He first noticed that his sight was at fault in the morning, while at work in his grounds; it grew gradually more and more dim, and before night it was totally lost. An examination of the eye disclosed the existence of a well developed cataract. The man was perfectly well at the time. He had lost the sight of the other eye by inflammation some years before.

The disease may begin simultaneously in both eyes, or one organ may suffer for a time, and then the other may become affected in the same manner. There are cases, however, and they are by no means uncommon, in which the cataract is limited to one eye, the other escaping altogether, even if the patient survive the occurrence a long time. It is generally supposed that, when one eye is cataractous, the other will, sooner or later, become cataractous also, in consequence of their sympathetic connection; such an explanation, however, is obviously altogether insufficient, and we shall probably be much nearer the truth if we ascribe the secondary affection to the same causes as the primary one. The starting point of the opacity is usually the centre of the lens, from which it gradually extends towards its periphery until the whole body is changed in its appearance.

*Morbid Anatomy.*—Cataract varies much in its color, form, and consistence; so much, indeed, is this the case that hardly any two instances of the disease are precisely alike.

The most common *color* of cataract is whitish, with various intermediate shades of grayish, yellowish, greenish, or brownish. The whitish appearance may be dull and lustreless, or of a shining, glistening, or pearly character, like the interior of certain shells, or the surface of a silver coin. A yellowish, cineritious, amber, or pale buff tint is sometimes observed, although it is infrequent. A greenish, olive, or bluish-gray hue is also rare, and is generally indicative of a complicated state of disease. A brownish cataract is very uncommon; and, as to the black variety of the affection, so much insisted upon by Beer and other German authors, I have never seen an example, although I would not go so far as altogether to deny its existence.



That it is extremely rare is evident from the fact that it is so seldom met with in practice.

The color of cataract is rarely uniform throughout the entire extent of the diseased structure; on the contrary, it is generally a shade or two darker at the centre than at the circumference. Cases occur in which the lens has a radiated, spoke-like, or stellar disposition, caused simply by the lines which produce this appearance being of a darker color than the intervals between them. The capsular cataract is often a few shades lighter than the lenticular, and is also generally of a more uniform color. It has sometimes a speckled, dotted, or punctiform appearance.

In its *consistence*, cataract varies from the fluidity of milk to the solidity of cheese, fibro-cartilage, cartilage, and even bone. The softer forms of the disease are most common in children and young subjects; the harder, in old age and decrepitude. The fluid cataract is a rare occurrence; I have never seen more than three cases of it, and in those the lens was so soft that its contents escaped and diffused themselves through the aqueous humor the moment the needle penetrated the capsule. In general, the consistence of the lens is equal to that of jelly, curds, a thick solution of isinglass, or the white of a soft-boiled egg. The hard cataract exhibits numerous varieties. Thus, it may be of the solidity of hard cheese, cartilage, bone, chalk, or earthy matter, very dry, inelastic, and incompressible. Capsular cataract is generally more or less tough, especially when old, and indisposed to yield under the pressure of the needle. The Morgagnian cataract is always fluid, or composed of a substance resembling whey, milk, or thin curds, both in color and consistence. It is worthy of note that an opaque lens is usually a few shades darker in the eye than it is after it has been extracted.

The *size* of the lens, in a state of opacity, may be natural, augmented, or diminished. An increase of volume is most common in young subjects; elderly persons, on the contrary, have more frequently atrophy of the lens. In congenital cataract, or cataract coming on soon after birth, the lens is often completely destroyed, or so much wasted that it may be said to exist only in a rudimentary state. The capsule, in such a case, either retains its normal volume and shape, or it is shrivelled into a small, hard, and irregular mass, hardly as large as a currant.

A form of cataract, to which the term *lamellar* has been applied, has recently excited a good deal of attention. It was first noticed by Jæger, and was afterwards well described by Graefe. A short but graphic paper on the subject, setting forth the peculiar nature of the disease, was published by my friend, Dr. E. Williams, of Cincinnati, in the North American Medico-Chirurgical Review, for September, 1857. It is most common in children under seven years of age, and essentially consists in a circumscribed opacity of a thin lamella of the lens: the periphery and central nucleus of which generally retain their natural transparency. Its progress is usually very slow, and it frequently happens that it remains completely stationary for years, if not during the rest of life.

Cataract may exist as an independent affection, or it may be associated with other lesions. In the idiopathic form of the disease the different structures are generally healthy; but when it has been caused by inflammation or external injury, it is often associated with disease of the cornea, iris, choroid, and retina, which thus seriously complicates the capsulo-lenticular malady, and exerts an unfavorable influence upon the prognosis. The general health may be perfectly natural, or variously altered; and this circumstance, again, may materially affect the issue of our curative measures.

*Symptoms.*—Cataract usually begins as an opaque speck immediately behind the pupil, in the centre of the crystalline lens, from which it gradually extends, until the whole of this body is of a whitish, milky, grayish, or drab color (fig. 201). Sometimes the affected part, instead of being distinctly opaque, has merely a nebulous appearance, as if it were suspended in the interior of the lens; at other times the opacity shows itself simultaneously at every point, though not with equal distinctness. The pupil is generally natural, and readily dilates and contracts under the influence of the light, its free margin forming a dark circle immediately in front of the cataract. The iris is unchanged in its shape, unless the diseased lens is unusually large, when it may be pushed a little forwards, and thereby rendered slightly convex. The cornea and aqueous humor retain their normal characters.

Fig. 201.



During the formation of cataract, the patient is conscious of impairment of vision, usually very slight at first, but gradually augmenting in proportion to the increase of the opacity of the lens and its capsule. He sees objects indistinctly, and, as it were, through a veil, haze, or mist; his sight is better in cloudy weather than in clear, and in twilight than in the bright sun, because the pupil, being then more dilated, admits a greater amount of light. In general, too, he can discern objects more distinctly by looking at them laterally than when they are placed directly in front of him. This is owing to the fact, already adverted to, that the opacity of the lens is generally greater at the centre than at the periphery, thus still permitting a certain quantity of light to come in contact with the retina. It is for the same reason that the sight is always temporarily improved by dilating the pupil with atropia. The formation of cataract is unattended with pain, intolerance of light, lachrymation, or disorder of the general health; and hence, but for the gradual loss of sight, the patient would not be aware at all of the existence of the disease.

*Diagnosis.*—The only affections with which cataract is liable to be confounded, are amaurosis and glaucoma. From these, however, it may, in general, be readily distinguished by the following circumstances, placed, for the sake of greater clearness and more easy reference, in tabular form:—

## CATARACT.

1. Impairment of vision is gradual, several months generally elapsing before it is completely lost.

2. The opacity begins at the centre of the lens, from which it gradually spreads towards the periphery; it is superficial, well defined, and of a grayish, whitish, yellowish, or pearl color. It is seen equally well, whether we view the eye sideways or directly from before backwards.

3. The pupil is natural, with a dark circle, and readily dilates and contracts under the influence of the light. It expands readily and freely under the application of atropia.

4. Vision is best in cloudy weather, in twilight, in shady places, and when the back is turned towards the light. It is also increased under the influence of atropia.

5. Cataract forms without pain, headache, intolerance of light, or constitutional disorder.

6. In cataract, there is merely a mist or haziness before the eye, with a distorted appearance of objects.

7. The sight is seldom entirely destroyed, however protracted the disease.

8. The expression of the countenance is comparatively natural and cheerful; the only perceptible change in the eye is the pupillary opacity.

9. The eyeball retains its natural consistence.

## AMAUROSIS AND GLAUCOMA.

1. Vision fails rapidly, and is often lost in a few days or weeks; sometimes, indeed, in a few hours.

2. It begins simultaneously at different points, is deep seated, diffused, indistinct, and of a bluish, greenish, or azure hue. It is seen most satisfactorily when we look directly into the eye, not laterally.

3. The pupil is widely dilated, insensible to light, and without any marginal circle. It dilates slowly and imperfectly, if at all, under the influence of medicine.

4. The patient sees objects most distinctly in a bright light, and in a particular direction, owing to the fact that the retina often remains sound, for some time, at one or more spots. No improvement of vision follows artificial dilatation of the pupil.

5. In amaurosis and glaucoma, there is often, if not generally, hemimerania, with neuralgia in or about the eye, sick headache, and other marked evidence of gastric and general derangement.

6. In amaurosis and glaucoma, objects of the most grotesque appearance are constantly floating before the eye, and the patient is annoyed with scintillations or flashes of light.

7. Completely lost in the confirmed stage of the disease; prior to this, it is often alternately better and worse, in consonance with the condition of the general health.

8. The countenance has a singularly vacant appearance, and the eye looks as if it were dead.

9. In amaurosis and glaucoma, the ball is often very soft, so that it may almost be indented with the point of the finger.

Much stress has been laid by some writers upon the value of the *catoptric* test, as a means of diagnosis in cataract. It consists in holding a lighted taper before the eye, the pupil being previously dilated, and the patient's back turned towards the window. If the cornea and lens are in a sound condition, three images will be perceived, two being erect, and the middle, or intermediate one, inverted. Of these images, the anterior is produced by the cornea, and is the most distinct; the posterior depends on the anterior surface of the lens, and is comparatively faint; the central is caused by the concave surface of the posterior wall of the capsule, and is the smallest of all. If the taper be removed, the two erect figures follow the light, but the inverted moves in the opposite direction. Now, in cataract, the middle one will be found, even at an early stage of the disease, to be very



obscure, if not altogether absent, and the deep, erect one, very indistinct. In pure amaurosis, the three images of the candle are quite distinct. In glaucoma, on the contrary, especially in its more confirmed stages, the inverted one is obliterated.

It is remarkable that any surgeon, however ignorant, should ever mistake opacity of the cornea for cataract; such an occurrence would hardly seem credible if I had not repeatedly witnessed it in my practice. I have, again and again, had patients sent to me from a great distance by men who ought to have known better, on account of supposed cataract, which, upon inspection, proved to be nothing but a white speck upon the cornea, the result of former inflammation. Such mistakes are always highly disreputable, since any one of the slightest knowledge or experience cannot fail, with proper care, to arrive at a correct diagnosis, and that, too, without the aid of the catoptric test, and of the ophthalmoscope, which are at present such hobbies with professed oculists as means of exploration.

The diagnosis of cataract will be greatly facilitated by the application of atropia, which, by dilating the pupil, enables us to observe the condition of the lens, and to determine the site of the opacity, as well as its nature and extent. Useful information in regard to the consistence of the cataract may generally be obtained by a consideration of the age of the patient, the duration of the disease, and the color and size of the opaque body. The cataract of infancy is frequently capsular, or, if any portion of lens remains, it is quite small; in children and young subjects, the lens is generally soft; in elderly persons, on the other hand, it is nearly always hard. A very white or pearl-colored cataract is ordinarily soft; so, also, a cataract of unusually large volume. The very hard cataract is commonly small, and of a yellowish, drab, or amber hue. A recent cataract is generally soft; an old cataract, hard. To these rules, however, there are, as might be expected, numerous exceptions, which should have due weight in our attempts at the establishment of a correct diagnosis.

The most important symptoms of *lamellar* cataract are nearsightedness and a peculiar expression of the features, such as so commonly attends partial blindness. The diagnosis, however, can seldom be satisfactorily determined without the aid of the ophthalmoscope.

What is called a *false cataract* is nothing but a layer of plastic matter, in a state of organization, which either completely fills the pupil, or which is stretched across this orifice, from one point of its margin to another. The opacity is immediately within the pupil, which is, at the same time, generally considerably contracted, and perfectly immovable, even, perhaps, under the influence of atropia. Vision is more or less impaired, and sometimes completely destroyed, the pupil being so completely shut up as not to admit a ray of light.

*Treatment.*—When cataract has once commenced to form, no remedies, or mode of treatment, can arrest its progress; on the contrary, it will be sure to advance until the opacity is complete, and vision is almost entirely lost. Should one eye alone be originally affected, the other is extremely liable to become affected also; whether by sympathy, or in

consequence of the same causes which occasioned the disease in the first instance, experience has not determined. The result of operation, which alone can prove of any benefit in curing the disease, will be influenced by a great variety of circumstances, among which the most important are the state of the patient's health, the presence or absence of complications, and the amount of inflammation consequent upon the interference. Infancy and old age are no bar to surgical interference or its success; I have operated repeatedly, with the most happy effect, within the first six weeks after birth, and upon subjects after the seventieth year. In three cases I have succeeded in restoring excellent vision at eighty, eighty-two, and eighty-three. In my own practice I never pay any attention to season, as is the case with some foreign surgeons. I prefer, however, to operate in the spring and autumn, although I never put off a case merely on account of cold or hot weather.

It is customary with all surgeons to subject their cataract patients to a certain amount of treatment before they have recourse to operative interference. Such a course cannot be too highly commended. It is particularly necessary in middle-aged and elderly subjects; not so much so in children and young adults, while in infants at the breast it may, in general, be altogether dispensed with. The extent of this preliminary preparation of the system must depend upon circumstances. If the patient is otherwise perfectly healthy, it need not be carried beyond the observance of rest and light diet for a week or ten days, and the administration of one or two very mild purgatives; under opposite circumstances, however, a longer ordeal may be called for. This is particularly true when there is a rheumatic or gouty state of the system, a disposition to neuralgia, or a tendency to inflammation of the eye. When this is the case, it is hardly possible to be too careful respecting the preliminary treatment. For the want of proper attention to this point I have seen more than one eye lost. In general, it is advisable not to operate until we are certain that the secretions are in the most healthy condition, and that all tendency, if any existed, to inflammation of the eyes has disappeared. If the individual is inordinately plethoric he may be bled once at the arm, and take an active cathartic every other night for a week before the operation. When a gouty or rheumatic predisposition exists, a preliminary course of colchicum may be necessary; and in such cases I have sometimes been in doubt whether interference should not always be postponed until warm weather has set in, as there will then be less likelihood of an attack of the disease.

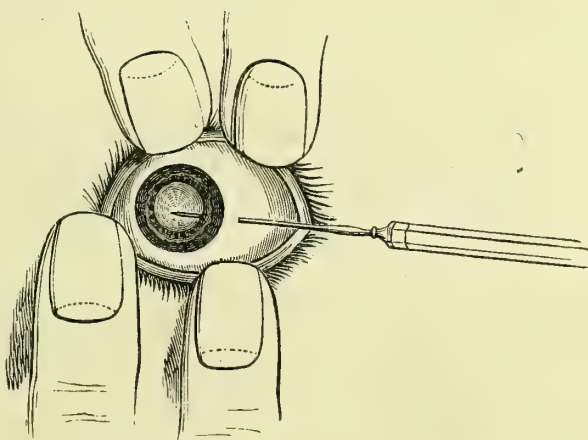
It is a good rule not to operate so long as one eye only is affected; for the reason that, if violent inflammation should arise, it may extend to the sound organ, and thus jeopard the safety of both. Besides, even if there were no risk of this kind, which, I think, has been much exaggerated, but the result be ever so favorable, still, the eyes, not being in the same focal condition, could not enjoy a similar amount of vision, and therefore the patient might, at least for some time, be worse off than before, although he had gotten rid of the opacity of the lens, and the consequent disfigurement of the part. Such operations are opera-

tions of expediency, and their performance is always of questionable propriety. In case, however, cataract exists in both eyes, although only in an incipient degree in one, the rule is to operate upon the bad eye now, and at some future period, when the sight shall have more declined, upon the other. What should be our rule of conduct when both organs are affected in an equal degree, or when the person is nearly or totally blind? This question has been answered differently by different writers. For my own part, I never hesitate to attack both eyes at the same sitting, believing that there is no more risk than when we operate only upon one organ, while the procedure has the great advantage of obviating protracted confinement, and preventing mental anxiety. I do not think that I have ever had cause, in a solitary instance, to regret this step.

The *operations* which have been devised for the cure of cataract are quite numerous, but they may all be referred to three principal methods, namely, displacement, division, and extraction. As these methods are not equally adapted to all cases, much judgment is often required in regard to their particular application. Thus, it may be stated, as a general rule, that extraction can be practised only when the cataract is hard, and division when it is soft. A hard cataract may also be depressed, but not a fluid one. Age likewise influences the choice of the operation. In infants and children we never extract, but limit ourselves to couching and laceration.

1. *Division of the Lens*.—Division of the cataract, or the operation by solution, consists, as the name implies, in cutting the opaque lens and its capsule into numerous pieces, and pushing them forwards into the anterior chamber, in order to subject them more effectually to the influence of the aqueous humor. The pupil is thoroughly dilated by

Fig. 202.



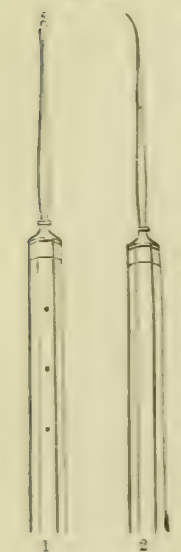
Operation of solution.

atropia, and the lids are disposed in the manner here exhibited (fig. 202), the patient sitting upon a chair with the head well supported by an assistant. The needle which I generally employ is one



of remarkable delicacy, perfectly straight, and sharp-pointed. Some surgeons prefer a curved instrument, as that of Scarpa, represented in the adjoining cut (fig. 203); but I have not been able to satisfy myself that it possesses any advantage over, if indeed it is equal to, the straight. Whatever may be its shape and size, it should be introduced at least two lines and a half behind the cornea, a little below the horizontal diameter of the eye, in order to avoid the long ciliary artery; the point should then be directed forwards in front of the lens and its capsule, which are now pierced and thoroughly comminuted, care being taken, before the instrument is withdrawn, to push as many fragments forwards as possible through the dilated pupil into the anterior chamber. The object of the whole proceeding is to bring the opaque structures, after they have been properly divided, under the influence of the aqueous humor, and the more effectually this is done the more rapidly will they be dissolved. It is still a mooted point whether the aqueous humor really possesses any solvent power or not, or whether the disappearance of the cataract is not entirely due to the action of the absorbent vessels of the membrane of Demours.

Fig. 203.



Scarpa's needle. 1. Front view. 2. Side view.

When we take into consideration the fact that pieces of cataract, both lenticular and capsular, which float about in the aqueous humor, often vanish in a very short time, without any but the most casual and transient contact with the structure here adverted to, it seems difficult to deny to this fluid such a property, although we may not be able to discover where it resides, seeing that it is composed essentially of water and a little saline matter, which are destitute of such properties out of the body.

Dr. Hays, of this city, who has much experience as an ophthalmic surgeon, has devised an ingenious instrument for cutting up hard cataracts, and experience has shown him that the operation is generally followed by the most gratifying results. The instrument, which is here represented of the natural size (fig. 204), combines both the advantages of a knife and a needle; it is very acute at the point, and has a double cutting edge, a little over four lines in length on one side, but much less on the other. The whole arrangement bears a very close resemblance to that of an iris-knife. The instrument is introduced in the usual manner, and brought in contact with the anterior surface of the opaque lens, which, together with its capsule, is then freely lacerated and divided in front, in order that the remainder of the body may be fully exposed to the action of the aqueous humor, and so become softened and ultimately absorbed. If this be slow in taking place, another operation is performed. If the cataract be comparatively soft, the whole of it may be completely divided at the first sitting. The pupil should be well dilated at the time of the operation, and, also, for some days afterwards.

There is another method of performing this operation, in which the needle is introduced at the lower part of the cornea (fig. 205), and made to act upon the capsule and lens through the anterior chamber. This is called the

Fig. 205.

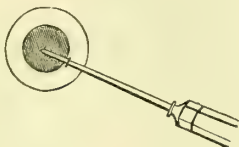


Fig. 204.



Hays's knife-needle.

operation of *keratonyxis*, or, simply, the anterior operation. The pupil being widely dilated, the head and eyelids are secured as in the more ordinary procedure, when the cataract is freely divided with a very delicate needle, either straight or slightly curved, as many of its fragments as possible being brought forwards in front of the iris. The instrument must be inserted near the outer border of the cornea, so that the resulting inflammation, if severe, may not lead to any injurious opacity, interfering with the transmission of light. I have performed this operation only a few times, and the result was such as to induce me to form rather an unfavorable opinion of it, as I found it not only awkward of execution but followed by too much excitement, at the same time that it does not possess, so far as I can perceive, any superiority over the posterior method.

The operation by solution is admirably adapted to the cataract of infants and young children. The patient being under the influence of anæsthesia, should be supported upon the lap of an assistant, or, what is preferable, his head should be placed between the surgeon's knees, while the body and limbs are held by a second person. If the exhibition of chloroform be undesirable, the little child is wrapped up tightly in an apron, as in the operation for hare-lip. This precaution is indispensable to the success of the undertaking. In other respects, the proceeding is the same as when we operate upon the adult.

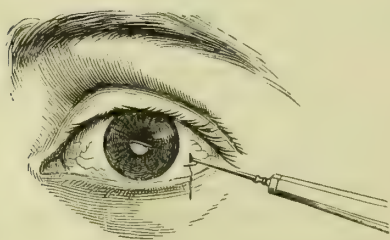
The question is often asked, At what period is it proper to operate in cases of congenital cataract? To this I unhesitatingly reply, at any period, provided the eye and general system are in a sound condition. I have repeatedly operated upon children under six months, and once upon an infant hardly four weeks old, and in almost every instance with the most gratifying results. Indeed, I have never, except in a solitary instance, and then I did not have charge of the after-treatment, seen anything like active inflammation after the operation, however early performed. My experience is that children, in general, bear this kind of meddling much better than grown persons,

their nervous system, although easily shocked, recovering much sooner from the effects of the operation than adults.

The operation of *drilling*, devised by the late Mr. Tyrrell, of London, is a modification of keratonyxis, and may sometimes be usefully employed in false cataract, or in ordinary cataract attended with great contraction of the pupil, or contraction of the pupil and adhesion of its edges to the anterior surface of the lens. It is executed by carrying the common straight needle through the cornea, and thence on across the pupil, into the centre of the opaque lens, which is then perforated in such a manner as to admit the aqueous humor. The process is generally obliged to be repeated from four to eight times, before a sufficient tunnel is obtained for the transmission of light for useful vision. Such an operation is of questionable utility, and might, I should suppose, be advantageously replaced, in every case, by the posterior procedure; for, besides the awkwardness attendant upon its performance, its frequent repetition is well calculated to lead to serious, if not destructive, inflammation.

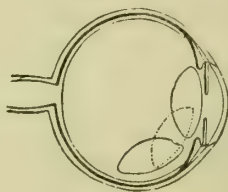
2. *Displacement of the Lens*.—In the operation by displacement, more commonly called the operation of couching or depression, the lens is removed from the axis of vision, and buried in the substance of the vitreous humor. The pupil being widely dilated, the patient's head properly steadied, and the lids held out of the way, a curved needle, very delicate, and somewhat spear-shaped, is pushed across the coats of the eye, at least two lines and a half behind the cornea, and carried carefully forwards until the point becomes visible in front of the cataract (fig. 206). The point being now applied against the lens, this is next pressed downwards and backwards into the vitreous humor (fig. 207),

Fig. 206.



Depression of cataract.

Fig. 207.



Depression.

beyond the axis of vision, and out of reach of the retina and the ciliary processes. The needle, being disengaged, is retained for a few seconds in the eye, to ascertain whether or not the cataract is disposed to rise; if it is, it is again depressed, and now with still greater care. I do not find it necessary, as some operators seem to do, to lacerate the anterior segment of the capsule as a preliminary step in this operation; on the contrary, I prefer, whenever this is practicable, to dislodge both lens and capsule at the same time. Where this precaution is neglected, there is danger that a portion of this membrane will remain, and afterwards act obstructingly.



Two circumstances are absolutely necessary to insure the successful execution of this operation, namely, a certain degree of firmness on the part of the cataract, and a tolerably healthy condition of the vitreous humor. If the lens be soft, it will be impossible to depress it; and, on the other hand, if the vitreous humor be fluid, or partially dissolved, it will be impossible to prevent the lens from rising after it has been displaced. These facts are self-evident, and do not, therefore, require any special illustration.

The result of the operation is liable to be marred by the occurrence of retinitis; and the possibility of such an occurrence is not merely in the first instance, within a few days or weeks, for example, after the operation, but secondary, that is, a long time after the patient has recovered from its primitive effects, and, perhaps, years after he has enjoyed excellent sight. The cause of this is the pressure which the depressed lens exerts upon the retina and the ciliary processes; and hence, as already intimated, the surgeon cannot be too cautious in guarding against this contingency in performing the operation. This, however, unfortunately, will not always be a sufficient guarantee against this occurrence; for it is well known that the weight and pressure of the lens, even when this body is originally most eligibly situated, may gradually bring about a dissolved condition of the vitreous humor, and thus enable it to come in direct contact with the delicate and important structures here referred to. Such contact, no matter when it may take place, will, in most cases, excite inflammation of the retina, followed by complete disorganization of its substance, and, consequently, total loss of sight. There is reason to believe that the lens, if not too hard, ultimately disappears after this operation, or, at all events, all but its central and more compact portion; but cases are met with, as dissection has demonstrated, in which nearly the whole of it remains, and it is these which are likely to become a source of difficulty, perhaps, long after the eye has recovered from the primitive effects of the operation.

Professor Pancoast, with a view of obviating the objections against the operation of couching, as usually performed, has devised a modification of it, which he denominates *horizontal displacement*. The pupil being widely dilated, the needle, which is a delicate, angular, hooked one, is inserted just behind the commencement of the non-plicated portion of the ciliary body, either a little above or below the horizontal diameter of the eye; and the moment it has fairly entered the anterior portion of the vitreous humor, the handle is inclined backwards, in order that the convex part of the point may be carried safely forwards in front of the lens, without endangering the iris and ciliary processes. The capsule being now freely lacerated, the hook is fixed in the centre of the lens, which is then gently drawn backwards, along the track made by the needle, until it comes opposite the puncture, where it is allowed to remain, care being taken not to let it press with any force against the retina.

The advantages of this operation, as claimed by Professor Pancoast, are, first, that it is not attended with any injury to the iris and ciliary processes, and, secondly, that, being suspended in the vitreous humor,

the dislocated lens is not liable to press upon the retina, and so cause destructive inflammation of that membrane and of the choroid. He states that he has performed the operation in numerous cases, and always with the most gratifying results.

For many years past, I have been in the habit of performing a *mixed operation* for cataract, consisting in a combination of division and couching. The procedure, as the name implies, is executed by breaking up the outer and more fluid portions of the opaque lens, and burying the remainder in the substance of the vitreous humor. It is, consequently, not adapted either to the very soft or to the very hard cataract, but to a union of the two; an occurrence sufficiently frequent to render the operation one of no little importance. Not having preserved a record of my cases, I am not able to state how often I have performed this operation, or with what results; I am, however, positively certain that it has never been productive, in my hands, of violent, much less of destructive inflammation, and that in nearly every instance the patient had good vision afterwards. The pupil is dilated, as in the ordinary procedure, and everything else is precisely similar.

I do not deem it necessary to describe the operation of *reclination*, as it is termed, a modification of the ordinary process of displacement, inasmuch as I think it should be banished from practice. I have never performed it myself, but the cases of it that have fallen under my notice have all speedily terminated in total blindness.

3. *Extraction*.—The operation of extraction is a much nicer and much more delicate procedure, than that of depression or laceration; it requires great coolness and dexterity on the part of the surgeon, and the most thorough co-operation on the part of the patient, for its successful execution. It is said of Wenzel that he spoiled a whole hatful of eyes before he had learned the art of extracting. This statement, without being strictly true, affords an excellent illustration of the difficulties which attend this operation, and a reason why so few practitioners are found who are ready and willing to undertake it.

Extraction is adapted only to certain forms and conditions of cataract. Thus, it is absolutely necessary that the cataract should be hard; that there should be a very convex cornea, and a sound pupil; and lastly, that the eye should not be situated too deeply in its socket, or, what is the same thing, that there should not be too prominent an arch, interfering with the requisite manipulation in performing the operation. Where the reverse of these conditions obtains, extraction of the lens will either be wholly impracticable, or attended with so much risk as to render the attempt improper, if not unjustifiable. Infancy and childhood are also bars to the operation. When well executed, and all the pre-existing circumstances are propitious, it is the least objectionable operation of all; the whole of the opaque body is disposed of at a single sitting, the corneal wound generally heals by the first intention, and there is no danger either of immediate or secondary injury to the internal structures of the eye. On the other hand, if the greatest precaution be not exercised, there may be a sudden and unexpected escape of the different humors of the organ, followed by complete collapse, or the eye may be destroyed within the

first few days by the resulting inflammation. The latter risk, however, is shared by this operation in common with that of depression and of laceration.

In performing the operation, the patient may either sit upon a chair, with his head reclining against the breast of an assistant, and held perfectly quiet; or, which I always prefer, lie upon a lounge, sofa, or narrow bed, the head and shoulders being properly supported by pillows, so as to render the former almost horizontal. If the patient is very timid or nervous, I do not hesitate to place him under the influence of chloroform, satisfied that the risk of losing the eye by vomiting is an extremely remote and improbable one. The pupil is not dilated as in depression and laceration. The upper lid is raised by an assistant, with the precaution of not pressing upon the eye, while the globe is fixed by seizing hold of a fold of the conjunctiva a quarter of an inch below the cornea, with the instrument sketched in the adjoining cut (fig. 208), and which also depresses the lower lid. The eye is now drawn somewhat down, when the surgeon, armed with a Beer's knife (fig. 209), to which I generally give the preference, inserts the point—supposing he is operating upon the left organ—

Fig. 208.

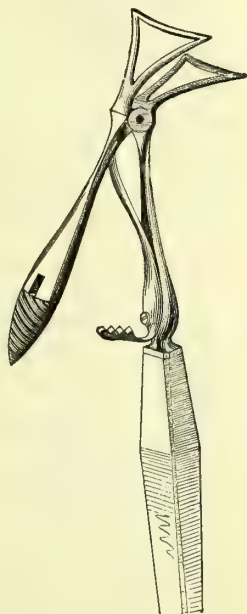
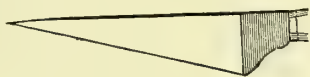
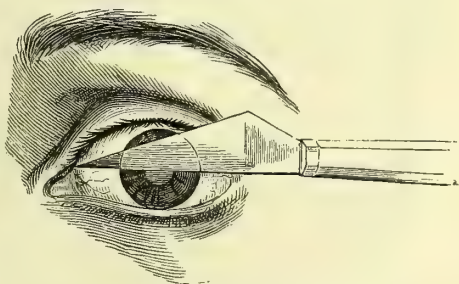


Fig. 209.



into the cornea within a third of a line from its junction with the sclerotica, and a short distance below the horizontal equator. In executing this step of the operation, care must be taken to hold the instrument nearly vertically, otherwise we shall be apt to get between the lamellæ of the cornea, instead of puncturing this membrane, as is our intention. Seeing now the point of the knife in the anterior chamber, it is carried carefully and slowly across towards the opposite side, in front of the iris, and brought out in such a manner as to divide fully one-half of the cornea, either at its upper, lower, or infero-external aspect, as may be most convenient; for, in point of utility, it really does not matter which, though the upper section is

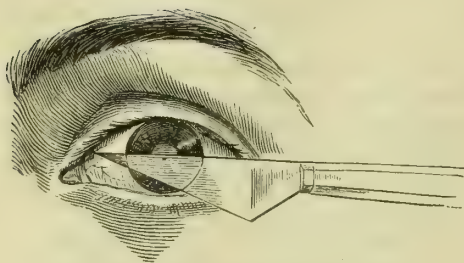
Fig. 210.



Superior section of the cornea.

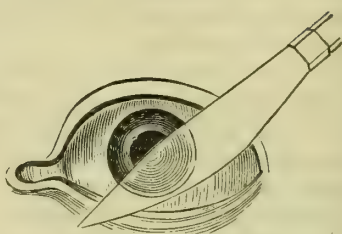


Fig. 211.



Inferior section of the cornea.

Fig. 212.



Exterior and inferior section of the cornea.

Fig. 213.



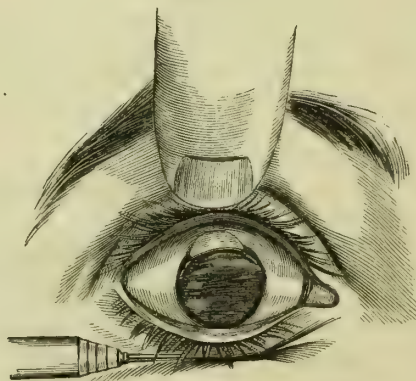
Curette with silver scoop.

usually preferred. The extremity of the knife issues at the same distance precisely from the sclerotica as that at which it entered. These several procedures are represented by the adjoining figures (figs. 210, 211, and 212).

The section of the cornea being completed, the eye is immediately liberated, and permitted to conceal itself behind its lids, in order to enjoy a moment's repose.

The next step of the operation consists in gently separating the upper lid, with a view of ascertaining whether the lens has any disposition to advance across the pupil. If it have, its expulsion is promoted by slight pressure upon the ball of the eye with the handle of a knife or the end of the index finger. Should this fail, the surgeon then introduces a delicate hook, represented in the accompanying cut (fig. 213), and lacerates the central portion of the capsule; the lens being thus liberated, now issues of its own accord, or, at all events, with the aid of a little friction upon the globe. Fig. 214 represents the lens as it is passing through the wound in the cornea.

Fig. 214.



Lens passing through incision of the cornea.

The third and last stage of the operation consists in replacing the iris, should it be prolapsed, in re-adjusting the flaps of the cornea, and in confining the lids by means

of several strips of isinglass plaster, with the twofold object of keeping them quiet and of preventing the introduction of the light. A light bandage, or, what is better, a very thin handkerchief, carried around the head, completes the dressing.

Several accidents are liable to happen during this operation, which the surgeon should take great care to avoid.

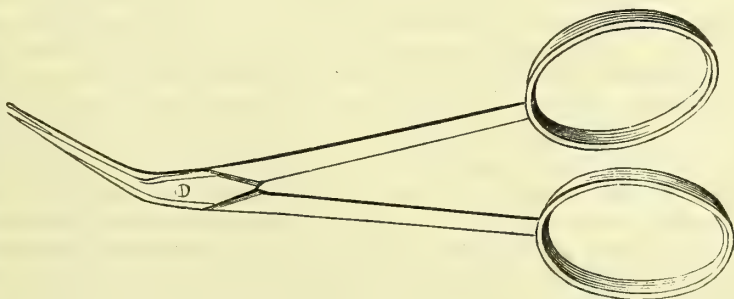
1st. The point of the knife may become entangled in the iris in making the section of the cornea; should this happen, the instrument must be disengaged, but not withdrawn, and the iris stimulated to contraction by gentle friction upon the cornea. This failing, the knife is laid aside, and the division completed with a probe-pointed bistoury (fig. 215), or a pair of scissors (fig. 216), one blade of which is blunt at the end. The flap, as already stated, should comprise fully one half of the circumference of the cornea.

Fig. 215.



Curved cornea knife.

Fig. 216.



Probe-pointed scissors.

2d. There may be prolapse of the iris: this occurrence is by no means unusual, and is generally easily remedied, replacement being readily effected with a small probe.

3d. There may be an escape of the vitreous humor, followed by partial or complete collapse of the globe. This may be occasioned simply by the involuntary action of the muscles of the eye, and, therefore, be wholly beyond the control of the surgeon; or it may be caused by too free a section of the cornea, or by inadvertent pressure upon the globe. However induced, the eye should instantly be closed, and after having had a brief period of repose, the parts should be readjusted, as under ordinary circumstances.

4th. The capsule may remain, the lens alone escaping, and thus rendering the cure imperfect. The proper plan, in such a case, is either to extract the capsule on the spot, or to dispose of it with the needle, when the eye shall have recovered from the immediate effects of the operation.

It sometimes happens, after the operation of extraction, that a portion of the capsule, hard, shrivelled, and incapable of absorption, remains in the eye, sadly interfering with vision, floating, perhaps, about behind the pupil. When this is the case, riddance is best

effected by what is called *linear* extraction, performed by making a small opening into the inferior and outer portion of the cornea, not more than the sixth or eighth of an inch in extent. Through the aperture thus made the offending substance may easily be drawn with a delicate hook or pair of forceps. A similar procedure may be employed when portions of a hard cataract, pushed forwards into the anterior chamber during the division of the lens, press injuriously against the cornea. The operation has the advantage of being very simple, and of not being followed by severe inflammation.

*After-Treatment.*—The after-treatment, in all these operations, is conducted upon the same rigid antiphlogistic principles. The light is carefully excluded from the apartment, the patient's head and shoulders are constantly maintained in an elevated position, the diet is of the mildest character, and the bowels are acted upon, at least every other day, by a moderately brisk cathartic. If active inflammation arise, blood is taken freely from the arm, and by leeches or cups from the temples, blisters are applied to the inner surface of the arm, and the eyes are frequently fomented with warm chamomile tea containing a few drops of Goulard's extract and of wine of opium. If there be much pain, especially if it is of a neuralgic nature, calomel and opium, calomel and Dover's powder, or, what will be found more efficacious than either, wine of colchicum and acetate of morphia, are freely used. As a general rule, the eye should not be inspected until the end of the third day, and then only in the most cautious manner possible; for the contact, even of the smallest quantity of light, often proves immensely injurious. The bandage may usually be dispensed with in a week or ten days, a green shade being used as a substitute. The eye must not be employed upon minute objects for several months, and the patient should consider himself for a long time as an invalid, avoiding all indiscretions, both bodily and mental. As the sight improves in strength, and all tenderness consequent upon the operation has disappeared, but not until then, he may begin to wear cataract glasses, of which he should furnish himself with two pairs; one for ordinary purposes, and the other for reading.

Much of the success which has attended these operations in my hands may, I think, be ascribed to the care which I have always taken in preparing the patient's system, and to the practice which I have pursued, for many years, of administering a full anodyne immediately after he has been put to bed. The article which I usually employ is sulphate of morphia, of which one grain may very properly be given, if the patient be an adult. This seldom fails to prevent pain, and to induce sleep, two circumstances of immense consequence as it respects the favorable issue of the case. If rest be of any value in the treatment of inflammation, surely it ought to be of the greatest possible benefit in this disease, when it affects so tender and delicate an organ as the eye; and I know of no means so well calculated to insure this end as a good, large dose of morphia, given in the way here specified. It is especially valuable in nervous, irritable persons, and in such as are liable to suffer from nausea and severe shock after trifling accidents and operations.



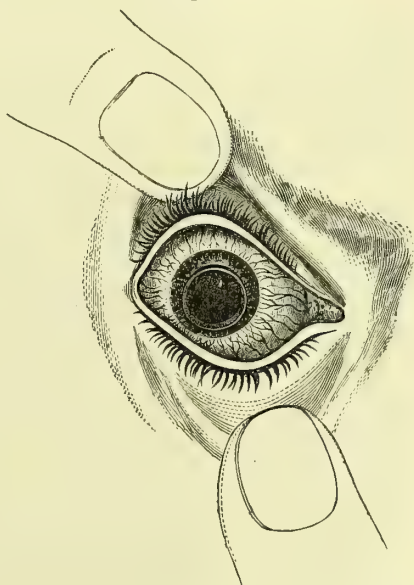
In regard to the relative merits of these operations, we are not in possession of any statistical facts which can aid us in deciding the question. My favorite method, as before intimated, has been, for a long time, the double operation of laceration and depression, and such is my confidence in its superiority that I shall continue to practise it until I have more substantial reasons than I now have for abandoning it. We have already seen that no one procedure is exclusively applicable to all cases, and there can be no question that each is capable of affording excellent results in the hands of a judicious surgeon. Destructive inflammation will occasionally follow, no matter how careful we are; no honest man will pretend to uniform success; everything may go on well for a number of days, and the case be, in every respect, most promising, when, all of a sudden, some unfavorable circumstance may arise, and the eye be irretrievably lost. Such a contingency should put us upon our guard, and render us cautious in respect to our prognosis. It is far better, after every operation for cataract, to promise too little than too much. The patient should always be told that he must bide his time.

## DISLOCATION OF THE CRYSTALLINE LENS.

Dislocation of the crystalline lens forwards into the anterior chamber (fig. 217) is a rare occurrence. I have met with but two cases of it. It generally comes on spontaneously, or without any assignable cause, although in some cases it is chargeable to external violence, directly or indirectly applied. Blindness, partial or complete, is the necessary consequence of such an accident, and it may easily be conceived how the resulting inflammation might destroy the eye. The following is a brief outline of the cases adverted to.

Catharine Monheimer, a married woman, aged thirty-six, a native of Germany, had been laboring under dislocation of the lens of the left eye for three years, when I first saw her, in October, 1849. The accident happened suddenly one night without any pain or even any unpleasant feeling, apparently while she was asleep. The next day, however, she was seized with violent pain and inflammation, which lasted for nearly two months, when it gradually subsided. It is worthy of remark that she had had no sight in that eye for seven years previously.

Fig. 217.



Dislocation of the lens into the anterior chamber.

The lens lay in the lower part of the anterior chamber, in close contact with the cornea and iris, and was of a conical shape, the apex looking upwards; it was opaque inferiorly, but semi-transparent above, and was so situated as almost to close the pupil. The cornea was natural, but the iris was tremulous, thrust back, or indented below, and changed in color, being much lighter than the right, which was of a grayish hue. The pupil was small, and immovable. The sight was completely destroyed.

The other case was that of a colored woman, aged forty-nine; the right lens, which had been dislocated for four years, without any assignable cause, was of a dirty drab color, and occupied the anterior chamber; it rested against the posterior surface of the cornea, and pressed aside the iris, the pupil being contracted into a narrow, slit-like aperture. The eye was completely blind, and had been the seat of neuralgia, off and on, ever since the accident, which was followed by severe inflammation.

The proper remedy for such an occurrence is obviously extraction of the lens, with the employment of active antiphlogistic measures, to moderate and relieve the resulting inflammation. If the case is one of long standing, the operation would still be proper as a means of improving the appearance of the eye, and preventing secondary effects.

#### DISEASES OF THE RETINA.

The retina, like the other tissues of the eye, is liable to inflammation and its various consequences, particularly effusions of fibrin, serum, and blood, leading to disorganization of its structure and to loss of function. The disease, at one time, is acute and characteristic, being marked by symptoms which no one can possibly mistake; at another, slow, chronic, and so obscure as to elude the closest scrutiny; now transient and easily combated; now inconceivably obstinate, and hopelessly irremediable. Considering the delicate structure of the retina, its concealed situation, the importance of its functions, and the extent and character of its connections, it is not surprising that the nature of its diseases should have been so long misapprehended, misinterpreted, and misunderstood. As these lesions are never fatal, few chances have been afforded of inspecting the eye after death, and therefore, much of what has been written about the pathology of this membrane is based rather upon conjecture than upon the results of actual observation. Now, however, that the ophthalmoscope has been introduced, we may hope soon to be able to elicit important information in regard to the nature and diagnosis of these affections, and, consequently, also respecting their treatment; already light is gleaming in the distance, and the combined researches of scientific surgeons in different parts of the world cannot fail to lead to useful revelations. If the instrument do no more than teach us the utterly hopeless nature of certain 'maladies, and the folly of treating them with harsh, injurious remedies, it will confer incalculable benefit; but it will, doubtless, do more; by enabling us to make out an early diagnosis in cases hitherto found

impossible of recognition, it will lead to the establishment of a more rational pathology and practice.

The only affections of the retina which will require notice in a work of this kind are acute and chronic inflammation.

1. *Acute retinitis* is rare as a pure, uncomplicated disease, but as a secondary affection it is by no means uncommon. There are few cases of violent sclerotitis, iritis, and corneitis in which the retina does not participate, to a greater or less extent, during the progress of the morbid action. The causes of the complaint are not always obvious. It is generally said to be owing to exposure of the eye to intense light, as in looking at the sun, or at the fire of a furnace; excessive and long continued fatigue of the organ; and to various kinds of external injury, especially such as involve the iris and ciliary ligament. In general, only one eye is affected at the beginning, but as the disease progresses the other may also be invaded, the probability of this being so much the greater if the inflammation be very intense and protracted. Acute retinitis is sometimes observed in lying-in females, within the first ten days after parturition. I have seen several cases of this kind, in each of which the attack seemed to be associated with, or dependent upon, a rheumatic state of the system. Very young subjects rarely suffer from this disease, except as a secondary affection. Finally, the inflammation may invade a part of the retina, or the whole membrane.

The most prominent *symptoms* of acute retinitis are, violent pain, excessive intolerance of light, profuse lachrymation, scintillations, and various kinds of spectres, with rapid failure of sight, generally eventuating in total blindness. The pain, perhaps intermittent at the commencement, soon becomes intense and distracting; it is deep-seated, darts about in different directions, and is often attended with intolerable hemicrania. The patient is annoyed by flashes of light, sparks, or luminous bodies, and by an endless variety of the most grotesque objects, which float before his eyes and disturb his imagination. The affected organ feels full and tense, as if it would burst, and the slightest motion or pressure is attended by an increase of the local distress. Photophobia and lachrymation are usually present in a marked degree, beginning early, and lasting throughout the attack. In the more violent and rapid forms of retinitis there is often total extinguishment of vision in a few hours, before there is any apparent involvement of the other structures of the eye.

The pupil, in acute retinitis, is, at first, slightly contracted, sluggish, and irregular; by and by, however, it becomes dilated, and ultimately, when the disease is fully established, it is expanded to the very utmost, and totally insensible to light. A vascular zone is often perceptible at the anterior part of the sclerotica, but it is much more faint than in iritis and corneitis, and is, therefore, of great diagnostic value. When the malady continues for any length of time, the other tunics of the eye participate in the inflammation; the iris is changed in its color, the cornea is rendered hazy, and the conjunctiva and sclerotica are red and deeply injected. Suppuration of the eye is a rare occurrence.

There is no disease with which acute retinitis can possibly be con-



founded. The distracting and intolerable pain, the flashes of light, the spectral illusions, the absence of the ordinary phenomena of disease in the other tissues of the eye, the motionless and dilated state of the pupil, and the rapid diminution of sight, with its ultimate complete extinguishment, are unmistakable evidences of the nature of the complaint.

The *prognosis* in this disease is most unfavorable. Even in the milder cases, complete recovery is seldom to be looked for, while, in the more violent, total blindness may be considered as inevitable. Under such circumstances, the retina is apparently completely overwhelmed by the disease, its substance being irretrievably disorganized by the inflammatory action. We cannot speak positively of the morbid deposits in this disease, but we may suppose that they consist of serum, fibrin, and blood, either alone, or variously combined.

The *treatment* of acute retinitis must obviously be of the most vigorous character; for, it need hardly be added, after what has been said respecting the rapid and destructive march of the disease, that, even if only a few hours are lost in indecision, the sight may be hopelessly destroyed. Copious venesection, leeches to the temples, active purgation, and the use of antimonials and opiates, with rapid ptyalism, are the remedies mostly to be relied upon. Unfortunately, the sight is often completely annihilated before we are able to see the case, the patient, in fancied security, hoping that the inflammation will soon subside of its own accord, when, in fact, it has probably already done its worst.

2. *Chronic retinitis* may be a sequel of an acute attack, or it may exist as an original and independent affection, coming on in a gradual and stealthy manner, slowly, but surely undermining structure and function. Among the more common causes of the disease are, over-exertion of the eye, long-continued exposure to vivid light, external injury, and neuralgia of the ophthalmic branches of the fifth pair of nerves. Excessive indulgence in eating and drinking, abuse of sexual intercourse, and suppression of habitual discharges, are also capable of producing the affection. A gouty and rheumatic state of the system has been known to predispose to an attack of this kind. Several years ago, a gentleman was under my care on account of chronic retinitis, contracted while travelling in a railroad car, during a long journey; he had formerly been a martyr to rheumatism, and had just suffered from a slight attack of his old complaint, when his eye became affected. The symptoms of retinitis had existed, in a gradually ingravescent form, for nearly two months, when, almost suddenly, they disappeared upon a recurrence of severe inflammation in the right knee. One of the most common causes of this disease, according to my experience, is circumorbital neuralgia. In the Southwest, chronic retinitis, from this affection, is by no means infrequent. During my residence at Louisville, a period of sixteen years, I met with many cases which clearly owed their origin to this circumstance alone. The operation for cataract by depression is occasionally followed by chronic retinitis.

The *symptoms* of the disease are generally strikingly characteristic. The patient complains of deep-seated pain in the eye, with neuralgic

pain in the forehead, face, and temple; he is annoyed with sparks, flashes of light, or luminous bodies, and his sight progressively diminishes, growing daily more and more dim, so that at length he can, perhaps, barely distinguish light from darkness. In general, he can see objects better in bright than in cloudy weather, and at noon-day than in twilight, especially when his back is turned towards the sun. Various fantastic objects usually float before his eye; everything looks as if it were veiled in a mist, haze, or spray; now an insect, as a fly, gnat, or spider, is in the way; now a shower of dust, or particles of dirt; now a thick cloud; now the bough of a tree, a cobweb, or gauze, or an appearance of shooting stars. If, before the sight is much impaired, the patient attempts to read, the letters will be found to look as if they were fused together, as if they were turned upside down, or as if they were unnaturally short or unnaturally long; his eyes become immediately fatigued and painful, and, for some hours afterwards, his vision will be proportionably more dim. The pupil, at first merely a little sluggish and somewhat dilated, becomes gradually completely insensible to light, and expanded to the very utmost, forming merely a black, narrow ring behind the cornea; besides, it is more or less irregular in its shape, the most common deviations being the oval and angular. The interior of the eye looks dead and lustreless, with a greenish, or slightly yellowish appearance; and the countenance has a peculiarly vacant stare, almost characteristic of the nature of the disease. In the more advanced stages of the complaint, the vessels of the conjunctiva are preternaturally numerous, large, and almost varicose.

Of the *pathology* of this disease, nothing definite is known. Generally beginning at a comparatively small point of the retina, the morbid action gradually spreads in different directions, until, at length, it involves its entire substance, from one extremity to the other. The most common alterations are, softening, deposits of fibrin and blood, and effusions of serum, with a varicose condition of the vessels of the retina and choroid.

The *prognosis* in chronic retinitis is unfavorable. If the patient is seen early in the attack, a complete cure may occasionally be effected, although such an event is to be regarded rather as the exception than as the rule. In general, the nature of the complaint is entirely overlooked, both by the patient and the practitioner, and the consequence is that the time when alone treatment is likely to be of benefit is allowed to pass by in the delusive hope of spontaneous relief. What renders the prognosis worse in this disease is that the morbid action nearly always involves the deeper structures of the eye.

The *treatment* of chronic retinitis must be conducted upon general principles, especially a consideration of the nature of the exciting cause, the stage of the complaint, and the condition of the patient's system. There is no question that, until very recently, this disease was usually most outrageously mismanaged; for, under the vague name of "amaurosis," by which it was generally known by practitioners, all kinds of remedies, of the most opposite and ridiculous nature, used to be resorted to, with no other result, commonly, than that of aggravating

the local mischief and inflicting serious injury upon the sight. It was the almost universal custom to bleed, purge, salivate, and starve such patients, often reducing them literally to death's door, by the consequent exhaustion. Such a course was well calculated to ruin both the eye and system. Now, that the mischievous effects of this practice have been fully exposed, there is not a little danger of carrying the error into the opposite extreme. We are too much disposed, at the present day, to cram and stimulate.

Anything like general bleeding and active purgation is only to be thought of in the event of decided plethora and great local congestion. Ordinarily, all the blood that ought to be removed, can be advantageously taken by leeches, or the use of a cup to each temple. The bowels should undoubtedly be kept quite free, and the best remedy for the attainment of this end, is blue mass, in union with compound extract of colocynth, or a few grains of calomel, rhubarb and aloes. The diet should be plain and simple, but rather nutritious than otherwise, particularly if there is evidence of debility, in which case it may also be necessary to exhibit some tonic, as iron and quinine. The great remedy, however, in chronic retinitis, is mercury, given in small doses, twice in the twenty-four hours, for several weeks, or even months, with a view to its general alterative action. The effects of the medicine are carefully watched; for anything even like an approach to salivation must be avoided. The mercury is administered, not for the purpose of making a direct impression upon the eye, but in the hope merely of improving its condition, by improving the general health. Counter-irritation by seton, blister or issue should receive early attention; the feet should be immersed every night for fifteen minutes in hot mustard water; the eye should be maintained in a state of the most profound quietude; a green shade should be worn to exclude the light, and gentle exercise should be taken daily in the open air. When there is much pain in the branches of the ophthalmic nerve, a large blister to the forehead often produces a most salutary effect. In such cases, too, strychnine will be useful, either alone, or in union with arsenious acid and aconite, it being understood that these articles are given in very minute doses, and only with a view to their general action.

Any tendency to relapse, which is always very great in this disease, must be counteracted by perfect quietude of the eye for a long time after all morbid action has apparently vanished, and by special attention to the state of the general health. Moderate exercise, a pure air, and the use of the cool or tepid shower bath, will go far in securing this result. A sea voyage proves sometimes eminently useful.

3. *Amaurosis*, a term much employed by ophthalmic writers, literally signifies obscure vision, from whatever cause arising, but, at the present day, it is restricted to dimness of sight, produced by disease of the retina. This lesion of the retina may be purely functional, and, therefore, temporary, or it may be organic, in the worst sense of the word, and, therefore, more or less permanent. Again, amaurosis may be partial, or complete; in the one case, the patient is still able to perceive light, and perhaps discern objects with some degree of satisfaction; in the other, he is totally blind, the retina being perfectly insensible to



the strongest light, however concentrated. It will thus be seen that the term amaurosis is used simply to denote the existence of a particular symptom, and not the pathology of the disease; a distinction of much practical consequence, and one which, unfortunately, is too often lost sight of by the practitioner.

Amaurosis may arise from a thousand *causes*, many of them of the most opposite and diversified character. A mere catalogue of these causes would make a large chapter. At one time it is purely inflammatory, at another wholly asthenic; in one case it is induced by plethora, in another by anemia; now it is purely functional, depending upon disease in other parts of the body, now entirely organic, or occasioned by the most serious structural lesion. Another circumstance, hardly less interesting in a practical sense, is that amaurosis sometimes comes on in an instant, literally in the twinkling of an eye, as when the organ is suddenly exposed to an intense light. Thus, persons have sometimes been struck down blind in gazing at the sun during an eclipse, or in looking at a bird in soaring through the air. Microscopists, artists, and other persons whose avocation demands great minuteness of sight, occasionally suffer in a similar manner. A flash of lightning has, more than once, produced irremediable amaurosis. Worms in the alimentary canal, the repulsion of cutaneous eruptions, the suppression of habitual discharges, derangement of the stomach, congestion of the brain, neuralgia of the fifth pair of nerves, inordinate sexual indulgence, the excessive use of quinine, profuse chewing, exhausting courses of mercury, and over-exertion of the eye, may all be enumerated as so many exciting causes of the disease. I recollect an instance where amaurosis was produced in an instant by the ferule of an umbrella thrust into the orbit in such a manner as to compress the ball forcibly against its bony walls. In two other cases, the disease was the result of a slightly contused and lacerated wound of the eyebrow, apparently implicating the supra-orbital nerve. Compression of the brain also, whether produced by effused blood, depressed bone, or some morbid growth, often leads to amaurosis; similar effects occasionally follow concussion of this organ, though they are usually of a transient nature.

Cases are met with, although they are rare, in which amaurosis observes an intermittent course, the loss of sight recurring once every twenty-four hours, very much like an attack of intermittent fever.

The *symptoms* of amaurosis are such as characterize chronic retinitis, and need not, therefore, be described here. A dilated, motionless, and insensible state of the pupil, a peculiar lustreless expression of the eye, total blindness, and a congested and enlarged state of the vessels of the conjunctiva, with a singularly vacant stare of the countenance, are signs which can never be mistaken.

It is obviously impossible to lay down any definite rules of *treatment* for a lesion whose causes are so numerous and diversified as those of amaurosis. The intelligent and conscientious practitioner will not fail to make the disease, in every case that may come under his observation, an object of special study and inquiry; often, indeed, his remedies must be addressed empirically, for, like the benighted navigator,

he will frequently find himself, so to speak, without rudder and compass. Cases, however, constantly occur where the causes of the disease are so apparent as to render it impossible to mistake them, and it is to this class that he should especially direct his skill and attention, since experience has shown that many of them are perfectly susceptible of cure. The old, and, perhaps, not yet entirely exploded practice of bleeding, purging, and salivating every patient affected with amaurosis, without any proper regard to the nature of the exciting cause, cannot be too severely censured. It affords a melancholy illustration of the folly of prescribing for the name of a disease instead of the disease itself. Undoubtedly plethora should be removed as well as debility, but this can usually be done by milder and more effective means, less likely to ruin the part and system. When the retina is totally disorganized, any treatment, however mild, must be wholly out of the question, except in so far as it may tend to improve the general health, and thus prevent a similar misfortune to the other eye, supposing that one alone is originally affected. One important use of the ophthalmoscope is to throw light upon this class of cases, and to afford information for a more rational plan of treatment.

#### DISEASES OF THE CHOROID.

The diseases of the choroid were, until a comparatively recent period, denied a place in the nosological tables of the internal ophthalmiæ; and there are many practitioners who still question the propriety of such a position. Their reason for such an opinion would seem, at first sight, to be well founded; but its fallacy becomes at once apparent when we reflect upon the structure of the choroid, its extraordinary nervous and vascular endowments, and its intricate relations with the retina, iris, and sclerotica. Its concealed position, doubtless protects it often from morbid action, to which some of the other tunics, which are more exposed, are so obnoxious. The fact is, it is the difficulty of distinguishing these diseases that has kept them so long in the back ground, and has caused the scepticism here alluded to. It has only been by the most careful and patient study that we are at length enabled to diagnose them with any degree of satisfaction. That their more delicate shades often escape observation, even now when they are so much better understood than formerly, is unquestionable, and this circumstance should admonish us to push our researches still further into their history and character.

The only lesion of the choroid, which will require special notice here is *inflammation*. That this is rare, as an independent malady, the united testimony of ophthalmological writers abundantly attests; while, as a secondary disease, it is probably quite frequent, often existing as a complication of iritis, retinitis, and scleratitis. It occurs at all periods of life, but is most common in young and middle aged persons, particularly in those whose avocation compels constant and intense application of the eyes to the purposes of minute vision. It has been asserted by the late Mr. Tyrrell that, soon after the death of the Princess Charlotte, of Wales, when the whole English nation went

into mourning, an immense number of cases of choroiditis occurred among the dress-makers of the British metropolis, on account of the immense labor imposed upon them by the mercenary conduct of those who had the control of their time and service. Many of these poor creatures, ill-fed, over-worked, and deprived of proper air, suffered from disturbance or loss of vision from this disease, brought on by excessive and long continued concentration of the eyes upon the black material used as the conventional garb of grief. The inflammation, in many of the cases, began in the choroid; in some it took its rise in the iris, retina, or sclerotica; while in a third series of cases it apparently commenced simultaneously in all, or, at least, in several, of these structures. Be this as it may, it is very certain that when the choroid is at all seriously inflamed the other tunics of the eye are extremely liable to become inflamed also; whether the converse of the proposition is true, in an equal degree, the present state of our knowledge hardly permits us to state. Congestion and subacute inflammation of the choroid are probably the cause of the morbid sensibility of the eye so common in young men at college and in literary persons, incessantly devoted to reading and writing. Strumous subjects, and persons who have become enfeebled by ill health, privation, protracted lactation, and loss of blood, are most liable to suffer.

The *symptoms* of acute choroiditis resemble somewhat those of retinitis, only that there is, in general, much less perception of luminous matter. The pain is deep-seated, dull, heavy, and throbbing, shooting about in different directions, especially towards the base of the brain, where it is often exceedingly severe. The eye is tender on pressure; there is a sense of tension or fulness; and every movement of the ball is attended with an aggravation of suffering. There is commonly severe pain, of an intermittent character, around the orbit and in the temple, and the patient is harassed with intense cephalalgia, and a feeling of weight and tightness in the forehead. The sight soon grows dim, and often disappears completely within a few days from the commencement of the attack. Various fantastic objects float before the eye; at first, as little moats or specks, of a grayish, yellowish, or darkish appearance, and afterwards, as the disease augments in violence, as a thick mist, gauze, or veil. The ball of the eye is of a dull reddish, pink, or brick-dust color, and there is generally a faint zone around the cornea, from which the vessels extend backwards over the surface of the sclerotica in fine radiating lines. The conjunctiva itself is seldom much injected. The iris is dull and discolored, and the pupil, contracted and irregular, soon becomes motionless, and adherent to the capsule of the lens, which, together with the lens itself, is frequently rendered opaque, either by plastic deposits, or by disease of their proper substance. Gradually the retina and vitreous humor are assailed, the latter being dissolved and broken down, and the globe, in consequence, converted into a soft, flaccid, fluctuating mass. The sclerotica, also becoming implicated, gives way at some particular point, usually towards the cornea, forming a protrusion, of a bluish color, known by the name of staphyloma.

Choroiditis is liable to be *confounded* with iritis, and, in fact, it is



often difficult, even in the earlier stages of the two diseases, to distinguish them from each other. In general, however, a little care in the examination of the eye, and a proper inquiry into the history of the case, will serve to determine the diagnosis. In choroiditis, disturbance of vision is an early and prominent symptom, and always precedes any alteration in the iris; moreover, the loss of brilliancy, and alteration of color of this membrane, are always less conspicuous than in the latter disease, and the vascular zone around the cornea is also more faint and dull. In iritis, the sight is often comparatively little affected for some days, although the affected structure usually undergoes very striking changes within a very short time after the establishment of the disease. Furthermore, in primitive iritis there is always a greater amount of plastic deposit in the anterior chamber, more irregularity of the pupil, and a more distinctly defined vascular zone around the cornea. When the two maladies have made considerable progress, the symptoms and appearances are generally so much alike as to defy all attempts at accuracy in diagnosis. In such an event, the only guide we can have is the history of the case.

The *prognosis* of choroiditis is unfavorable. When the disease has made much progress before we have an opportunity of interposing our remedial measures, the chances are that the sight is already destroyed, or, at all events, so much impaired as to render its restoration a matter of impossibility. Hence, the importance of an early diagnosis, and of an efficient treatment.

The *treatment* of acute choroiditis must, in the main, be conducted upon antiphlogistic principles, with a proper regard, however, in every instance, to the state of the constitution, the violence of the attack, and the age of the patient. A plethoric condition of the system will demand bloodletting, copiously, and, perhaps, repeatedly, with leeching, or cupping of the temple, active purgation, and the use of mercury, carried to rapid ptyalism. Reduction of the inflammation must be attempted at all hazards, and in the shortest possible time; a few days, or even twenty-four hours, passed in temporizing, may lead to hopeless blindness. The treatment is, of course, less active when the patient is feeble from previous disease, or present suffering, or when the inflammation has already produced structural lesion; here our chief reliance is upon local depletion, counter-irritation by blisters to the forehead, temple, or nape of the neck, correction of the secretions, mild aperients, and the gentle operation of mercury, with nutritious food and drink. When the disease has assumed a decidedly chronic form, a change of air, sea-bathing, and tonics, particularly iron and quinine, will aid in rebuilding the constitution, and contributing to the maintenance of what little vision may be left.

#### STRUMOUS DISEASES.

Strumous ophthalmia exists in various forms and degrees; sometimes as a very mild affection, at other times, as a most severe one. It may attack both eyes, or be limited to one; and it may be acute or chronic. It generally involves, simultaneously, a number of structures, especially the conjunctiva, cornea, iris and retina.

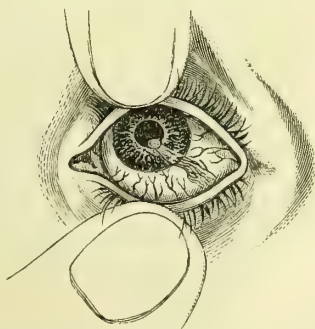
The prominent *symptoms* are intolerance of light, excessive lachrymation, and violent pain. The photophobia is usually very distressing. We constantly see cases in which the smallest ray of light is productive of the keenest suffering, and where, consequently, the patient uses every possible precaution to prevent its intrusion. For this purpose he generally, if he be a child, as is commonly the case, creeps into the darkest corner of his chamber, where he covers his eyes with his hands, or buries his head in a pillow, or, perhaps, in the lap of his mother. In this condition he often remains for hours, afraid to change his posture, lest the light should meet his eyes, and thus increase his distress. Children thus affected, frequently experience an aggravation of all their suffering, even from the light of the moon and of the stars, such is the excessive sensibility of the retina. Photophobia, then, or intolerance of light, is a most important diagnostic symptom in this affection, and one which no practitioner should disregard.

The *lachrymation* also exists in various degrees. In most cases it is, at one stage or other of the complaint, a prominent symptom. Exposure to light and cold always increases it. The tears are usually hot and scalding, and their discharge is almost always attended with temporary relief. Sometimes they are so acrid as to irritate the cheeks, causing them to become red and swollen. The quantity of lachrymal fluid that is thus evacuated in the twenty-four hours may amount to several drachms.

It is rare, in strumous ophthalmia, to witness a copious discharge of *mucus*, or of muco-purulent fluid. Even when there are excessive photophobia and great lachrymation, it is seldom that there is much secretion of this description; often, indeed, not enough to agglutinate the edges of the lids. In this respect, scrofulous inflammation forms a striking contrast with some of the other varieties of ophthalmia, in which an immense quantity of mucus, or of mucus and pus, is discharged during the height of the morbid action, and even during its declension.

There is usually, as already stated, but little *redness* of the conjunctiva, in this variety of ophthalmia. In ordinary inflammation, discoloration of this membrane is a constant occurrence, and so conspicuous as generally at once to attract attention. In strumous inflammation, the vessels observe a straggling arrangement; they are seldom very turgid, and they extend from the circumference of the ball inwards towards the cornea, where they are often congregated into little groups, or clusters, beautifully interlacing with each other (fig. 218). When the disease is violent, or of long-standing, the vessels occasionally pass over the cornea, either singly or in parallel lines, separated by narrow intervals. In ordinary ophthalmia the vessels are extremely numerous, and

Fig. 218.



Scrofulous ophthalmia, with phlyctenulae on the cornea and a fasciculus of vessels running into it.

lose, so to speak, their individuality. In a word, there are hundreds, where there is one in strumous ophthalmia.

Another important symptom in this form of ophthalmia is the existence of little minute *vesicles* at the margin of the cornea, occurring either separately or in groups, and varying in size from the smallest perceptible speck to that of an ordinary pin-head. They contain each a minute quantity of serum, and are frequently encircled by a delicate plexus of vessels, which impart to them a very beautiful appearance. Their shape is globular, ovoidal, or angular. Sometimes they exist partly on the sclerotica and partly on the cornea. As they are witnessed in no other form of ophthalmia, they are of great value as a diagnostic sign.

Strumous ophthalmia seldom continues long without giving rise to *opacity* of the cornea. This effect, like some of the others that have been mentioned, presents itself in different degrees, from the slightest haziness of the part to complete opacity. In the latter case, it is always to be greatly dreaded, inasmuch as it is generally followed by total blindness. Its occurrence should always, if possible, be prevented, not only because it is liable to impair the sight, but because it must necessarily, when irremovable, disfigure the eye, and injure the expression of the countenance. It need hardly be added that the immediate cause of this phenomenon is a deposit of lymph into the substance of the cornea.

*Ulceration* of the cornea is another effect of this variety of ophthalmia, and one, in fact, of frequent occurrence. It often begins at an early stage of the disease, and may proceed, with more or less rapidity, until it extends through the entire thickness of the membrane. The most common form of the ulcer is that of a dimple-shaped depression, with smooth and rather sharp edges, the surface looking as if a piece had been scooped out of it. Generally, the ulcer has a hazy appearance, but not unfrequently it does not differ in its color from that of the adjacent parts, and hence, unless the cornea is examined with great care, while the light is falling upon it at a particular angle, the disease may readily escape detection. Sometimes, several such ulcers exist upon the eye, forming either simultaneously, or in pretty rapid succession. If permitted to progress, they occasionally extend through the different layers of the cornea, as far as the anterior chamber of the eye, the humor of which may perhaps escape through the abnormal opening, or, what is more common, the opening is closed up by the membrane of the aqueous humor, or even by the iris itself.

The *pain* attendant upon strumous ophthalmia is sometimes intense, while at other times it is very insignificant, if not wholly absent. In confirmed cases, it is always aggravated by the slightest exposure of the affected organ to the light, by medicated applications, by disorder of the bowels, by indulgence in eating, by rough contact, and by various other circumstances unnecessary to be mentioned. Occasionally it is situated deeply in the ball of the eye, in the orbit, or at the base of the anterior lobes of the brain; sometimes it affects merely the lids and brows; occasionally, it is most severe in the temple, forehead, or cheek. It may be sharp, shooting, or darting; dull, heavy, or aching; throb-



bing, or pulsatile; continued, or intermittent. Not unfrequently it assumes a neuralgic character, recurring periodically, like neuralgic pain in other parts of the body. Whatever may be its nature, it is often so severe as to deprive the patient of sleep and appetite, and, indeed, of all comfort, for days and weeks together.

Strumous ophthalmia is rarely attended with any *tumefaction* of the lids. On the contrary, these structures usually retain their normal shape and size; but, in consequence of the excessive intolerance of light, they often present a remarkably drooping appearance, owing to the manner in which they are drawn over the eyes. When the disease is very protracted, the edges of the lids frequently become inverted, so that the ciliæ impinge constantly against the cornea, thereby inducing opacity of this membrane, great increase of pain, and additional inflammation. Although, in general, there is an absence of swelling of the lids, yet this symptom will occasionally be found to exist in a very marked degree. This is especially apt to happen in young children of a leucophlegmatic habit, with a thick upper lip, a tumid belly, and a soft, flabby tongue, along with great derangement of the digestive apparatus. The whole system, in such cases, seems to be surcharged with strumous disease, which, in consequence, it is extremely difficult to dislodge from the eyes, which frequently become its victims.

In many cases, there is an appearance of little vesicles on the cheeks, the inferior lids, round the nose, or on the lips. Their number varies from two or three to several dozens; their volume rarely exceeds that of the head of a small pin; and their contents are of a serous character. They have a whitish, almost pearly aspect, are usually discreet, though often closely grouped together, and rest upon a slightly reddish base. These vesicles, according to my observation, are most common in children of a deeply-marked strumous habit, and they seldom manifest themselves until after the inflammation has made considerable progress. I always look upon them with a feeling of suspicion in regard to the ultimate issue of the case; for their presence almost invariably denotes great obstinacy in the morbid action, and proportionate difficulty in effecting a prompt and permanent cure.

From the symptoms which have now been detailed, we can hardly fail to establish the *diagnosis* of this affection in any case that may fall under our observation. The excessive intolerance of light, the unwonted lachrymation, the absence of redness in the conjunctiva, together with the peculiar straggling arrangement of its vessels, the want of tumefaction, and the manner in which the lids are drawn over the ball of the eye, are signs which, once observed, can never be mistaken. Add to these phenomena the fact that the disease usually arises insidiously and without any assignable cause; the strumous appearance of the features; the coldness of the extremities; the tumid condition of the belly; the formation of vesicles on the face, and various other evidences of the strumous diathesis, and all doubt respecting the true nature of the case must instantly vanish. Indeed, no practitioner, unless he is culpably ignorant of ophthalmic diseases, can possibly commit an error of this kind.

The *prognosis*, in this disease, must necessarily be influenced by

various circumstances, as, for example, the progress and extent of the morbid action, the state of the patient's health, and the nature of our remedies. In the milder forms, and in the earlier stages of the malady, and under proper management, recovery of the affected organ may generally be reasonably predicted. But, under opposite circumstances, the worst consequences may, not unfrequently, be looked for. Ulceration of the cornea often extends, despite our remedies, to a great depth, and sometimes even to complete perforation; an event which is sure to be followed by permanent impairment, if not total loss, of sight. Superficial opacity, even when it is diffused over the greater portion of the cornea, is generally readily amenable to treatment, but when it involves several of the layers of the membrane, or when a considerable period has elapsed since its formation, or, in other words, when time has been permitted for the organization of the lymph, upon the presence of which the opacity depends, then the case will necessarily be unpromising, both as it respects the future appearance of the eye and the amount of vision. It is fortunate that strumous inflammation of this organ rarely terminates in gangrene of any of its structures. Such an event, judging from my own observation, is extremely infrequent.

Of the exciting *causes* of this disorder very little is known with any degree of certainty. Very frequently its origin is ascribed to circumstances which have no agency whatever in its production. Sometimes it is directly traceable to external injury, as a blow, or a wound; in many cases it is apparently brought on by long exposure of the eye to a strong light, or by excessive fatigue of the organ, induced by reading, writing, or sewing. Suppression of the cutaneous perspiration is probably another, if not a frequent, cause of the disease. In young girls, I have occasionally seen it connected with irregularity of the menses, but whether as a cause or an effect has not always been apparent. Perhaps the most common cause of all is derangement of the digestive apparatus. Whenever the predisposition exists, as it always does in this affection, almost anything, however trivial, may bring on an attack.

The disease may be *limited* to one eye, or it may occur in both, either simultaneously or successively. I do not deem it necessary here to insist upon the minute, and, as I conceive, unmeaning divisions and subdivisions of strumous ophthalmia laid down by systematic writers on the diseases of the eyes. Such an arrangement can subserve no useful purpose in practice, and would be entirely out of place here. It is sufficient to say that, in nearly every instance of this complaint, there is an involvement of the conjunctiva and cornea, if not also of the sclerotica and iris, and not simply of the conjunctiva and cornea, or of one of these structures alone, as one might suppose by reading books, and neglecting observation. In all cases, the retina is either inflamed or morbidly sensitive, as is evinced by the excessive intolerance of light attending the malady.

The *age* at which this disease occurs is an important circumstance in its history. It is extremely rare for it to begin after the period of puberty, and in no instance have I witnessed its outbreak in middle or advanced life. It is emphatically a malady of infancy and early

childhood. According to my observation, it rarely shows itself before the age of eighteen months, or two years. It occurs in both sexes, and in every rank and condition of life, but more frequently among the poor, ill-fed, and ill-clothed, than among the refined and wealthy. The offspring of the consumptive, and of those who have suffered from tubercular disease of the spine, hip, arachnoid membrane, and lymphatic ganglions are most liable to it.

*Treatment.*—The great remedy in the treatment of this disease is quinine, either alone or in union with other means. I am very certain, from my experience in its management, that quinine deserves to be placed at the head of all other articles in this variety of scrofulous affections, and yet, in making this remark, it is necessary to introduce a proviso, lest the young practitioner should thereby be induced to invest it with a degree of confidence to which, valuable as it is, it is not entitled. What I wish to say is simply that this medicine will, if properly administered, that is, with due regard to the patient's system and other circumstances, produce the most prompt and salutary effects; while, if these precautions be neglected, it will either prove useless or even cause mischief. There are, according to my experience, two distinct classes of strumous disease of the eye. In the one, the patient is pale and thin, with a languid circulation, and cold extremities; in the other, he is stout and robust, the cutaneous circulation being active, and the hands and feet habitually warm. Other points of dissimilarity readily suggest themselves, but these it is unnecessary to point out, as the distinction which I wish to establish must be sufficiently apparent. Now, to treat such cases alike would be a palpable absurdity. It is only by properly discriminating between them that we can expect to arrive at a satisfactory result, as it respects the employment of this important therapeutic agent. Hence, one practitioner will often mismanage a case, which another, having more judgment and more experience, will promptly cure, the disease, perhaps, disappearing as if by magic.

In the commencement of my treatment in both forms of the complaint, I usually prepare the system by the exhibition of a moderately brisk cathartic of calomel and rhubarb, to clear out the bowels and correct the secretions. When there is reason to suspect that there is much acid in the alimentary canal, I generally combine with the cathartic a few grains of bicarbonate of soda. Thus, a most effectual beginning is made in the treatment of the disease. If the case comes under the first division, that is, if the patient is pale and thin, and is habitually laboring under cold extremities, I now begin the use of quinine, seldom alone, but commonly in combination with sulphate of iron, tartar-emetic, and opium, in quantities proportionate to the age and strength of the individual. For a child, for example, of ten years, a grain and a half of quinine, one grain of iron, the twelfth of a grain of antimony, and the eighth of a grain of opium, carefully mixed, will be a suitable dose, repeated every eight hours, or, if the symptoms are urgent, every six hours, or four times in the day and night. If pills or powders are offensive to the patient, the articles may be given in solution, substituting laudanum or morphia for the opium. When there is a highly-marked strumous diathesis, I some-



times use the iodide of iron instead of the sulphate, but in most instances I give the latter the preference. Tartar-emetic I rarely omit in any case, from the fact that it is one of the most valuable remedies we possess in the treatment of scrofulous disease, both of the eye and of other parts of the body. It is a powerful controller of capillary action, and at the same time a most potent sorbefacient, rendering it thus particularly applicable in all cases attended with deposits of coagulating lymph. The opium allays pain, renders the eye more tolerant of light, and prevents the antimony from irritating the stomach and bowels. The quinine and iron, whether in the form of sulphate or iodide, are powerful tonics; they improve and invigorate the digestive organs, increase the fibrin and coloring matter of the blood, equalize the circulation, augment the temperature of the extremities, and powerfully aid in correcting the strumous diathesis. By means of these remedies, assisted by a proper diet and due attention to the bowels and secretions, almost any case of scrofulous ophthalmia may, in the class of patients under consideration, be effectually relieved, and that, too, in a comparatively short period.

An excellent cathartic, in these cases, is calomel in combination with rhubarb; to which, as above mentioned, I occasionally add a few grains of soda, especially if there is reason to suspect the existence of a redundancy of acid in the alimentary canal. In a child from three to five years of age, about two and a half grains of the former, to five or six of the latter, should be given every fourth night. Occasionally the calomel may be advantageously replaced by blue mass; or, in infants, by the gray powder.

When the skin is dry and inactive, the tepid bath may sometimes be employed, or, what is better, the body may be sponged once a day with tepid salt-water, followed by frictions with a coarse dry towel. Flannel should be worn next the surface, both in summer and winter; and the greatest attention should be paid to the preservation of the temperature of the feet. When they are habitually cold, they should be plunged, twice a day, for a few minutes at a time, into cold water, and then be well rubbed with a dry cloth. It is a great mistake, in such cases, to bathe the feet in warm water, with a view to the restoration and maintenance of their temperature.

In the second class of cases, where the general health is apparently but little impaired, where the countenance is florid instead of being pallid, and where the extremities are, for the most part, warm, the quinine is most advantageously conjoined with sulphate of magnesia and tartar emetic, in the form of the saline and antimonial mixture. The following is the formula which I commonly employ under these circumstances:—

R.—Quiniæ sulph. ℥ss;  
 Magnesiæ sulph. ℥j;  
 Antim. et potassæ tartr. gr. jss;  
 Aquæ destillatæ ℥iij;  
 Syr. zingib. ℥j;  
 Tinct. opii gtt. xxx;  
 Acid. sulph. arom. ℥ss.—M.

Of this mixture, which, considering its ingredients, may be regarded

as an exceedingly elegant one, the dose is about one drachm for a child four or five years of age, repeated every four, five, or six hours. If it induce vomiting, or nausea beyond a few minutes, it should be diminished, or combined with more laudanum. When the inflammation is very severe, I often omit the quinine until the disease has assumed a subacute character, and in that case also I occasionally take blood freely from the arm, or by leeches from the anterior part of the temples, within an inch from the outer commissure of the lids. In the strong and robust, iron, in every form, is totally inadmissible. The diet, too, must be more restricted, and more active purgation is required. Indeed, the treatment should be strictly antiphlogistic, as much so as in inflammation of the eye from ordinary causes.

As to *counter-irritation*, collyria, and salves, so much used in this complaint, they cannot, as a general rule, be too much or too pointedly condemned. Except in the latter stages of the complaint, in some rare circumstances, it is difficult to conceive of any case in which they would be likely to be beneficial. I am only speaking my real sentiments when I declare that I know of no class of remedies which have done more mischief, or which are so well calculated to fret and annoy the patient, and to support and perpetuate the morbid action. Setons are abominably filthy and painful, and should be discarded from this branch of surgery; tartar-emetic ointment and croton oil cause injurious irritation; in short, the only eligible article of this class of remedies is a small blister behind the ear, or, what is preferable, because more easily managed and more permanent, a very small issue, in this situation, made with the Vienna paste. This, when the eschar is detached, may be dressed, twice a day, with a little adhesive plaster, and will furnish a free discharge for several weeks, when, if necessary, it may easily be reopened by the application of a little more paste, or some irritating ointment.

The best *collyrium*, undoubtedly, is a solution of nitrate of silver; but, to answer the purpose, it should be very weak, and not be used until the inflammatory action is greatly diminished, when it may assist in expediting and perfecting the cure by contracting the enlarged vessels of the conjunctiva and cornea, by allaying the morbid sensibility of the eye, and by promoting the absorption of effused lymph. The strength, at first, should rarely exceed half a grain to the ounce of water, which may be gradually increased to a grain, or even twice, thrice, or four times that quantity, according to the circumstances of the case. Sulphate of zinc, acetate of lead, Goulard's extract, and similar articles are generally worse than useless.

When there are ulcers on the cornea, and they do not yield to the remedies already enumerated, they should be touched, as lightly as possible, once every other day, with the point of a camel-hair pencil wet with a solution of nitrate of silver, in the proportion of about three grains to the ounce of water; or, with the nitrate of silver in substance. The former, however, is generally preferable, unless the ulcer is in a phagedenic or gangrenous condition, when the latter should take the place of the solution, as being more prompt and efficacious in its action.

The only *salve* which I ever employ in this affection is the ointment of the nitrate of mercury, in a very dilute state; generally in the proportion of about ten grains to the drachm of prepared lard. The ointment of the shops is entirely too strong, and cannot be used without the risk of materially augmenting the morbid action. Diluted in the manner above stated, it may be advantageously applied in all cases attended with great relaxation of the vessels of the affected part, opacity of the cornea, and adhesion of the lids. The proper way to use it is to anoint the edge of the lower lid with a small pencil, dipped in the salve, every night at bedtime. When the salve is stiff, it should be previously warmed, otherwise it will not be likely to adhere. Thus employed, a very small quantity, a portion not larger than half a grain of rice, will suffice.

Some patients experience great relief from frequently bathing the forehead, face, and temples with warm water, pretty strongly impregnated with common salt; while others derive most benefit from bathing with cool, cold, or hot water. In all cases the best plan is to permit the patient to consult his own feelings in the use of this remedy.

It need hardly be added that the eyes should always be carefully protected with a green shade; but on no account should the patient be allowed to wear green glasses, or, what is still more abominable and injurious, goggles. Such a practice, indeed, cannot be too much deprecated. The same remark is applicable to compresses and bandages. I have seen numerous cases in which irreparable mischief has been done by the protracted use of these articles. The true practice consists in protecting the affected organs in such a manner that, while they are sufficiently screened from the light to render the patient comfortable, they shall have the full benefit of cool air. As the morbid action declines, more and more light should gradually be admitted, until at length they receive their accustomed supply. It should never be forgotten that light is the natural stimulus of the eye, and that by withholding this stimulus for too long a time, the organ may become morbidly sensitive; just as the stomach becomes irritable and unable to perform its functions when it is for a long time deprived of food.

Finally, I may state that I have rarely derived any essential benefit, in the treatment of any form of scrofulous ophthalmia, from iodide of potassium, so much vaunted by some practitioners. Formerly I was in the habit of prescribing this article quite frequently, but it so often totally disappointed my expectations that I have, of late years, laid it entirely aside. In obstinate cases, we occasionally obtain benefit, especially in weakly children, requiring an alterant and tonic, from the exhibition of bichloride of mercury, in very minute doses, as the twentieth or twenty-fifth of a grain, in union with Huxham's tincture of bark. I am well aware that the salt in this prescription undergoes some chemical change; but this renders it, perhaps, only the more efficacious. It is neither necessary nor proper to carry the remedy to the extent of ptyalism to obtain its full effects. Indeed, such an occurrence should always be carefully avoided. Cod-liver oil is frequently



of great benefit, especially in the more feeble classes of cases, and should be given in such doses as the stomach will bear without nausea. When the debility is very unusual, the child should be permitted the free use of milk-punch, and the lighter kinds of meat.

When there is hemicrania, or excessive circumorbital pain, anodynes are necessary, particularly at night, both to allay suffering and to procure sleep. Under such circumstances, some practitioners are in the habit of applying belladonna ointment to the affected parts, and in some cases I have found the remedy of service, though, in general, it has disappointed me.

During the latter stages of the disease, the patient should take gentle exercise daily in the open air, as a means powerfully calculated to improve his general health, and to invigorate his constitution. In all cases, the greatest care should be employed to avoid exposure and indulgence of the appetite and passions. As another excellent means of guarding against relapse, a moderate use of the remedies above mentioned should be persisted in for a considerable time after all disease has apparently vanished.

#### MALIGNANT DISEASES OF THE EYE.

The only two forms of malignant diseases of the eye are encephaloid and melanosis. The variety of soft cancer, known under the name of fungus hematodes, is by no means infrequent, but as it generally occurs in combination with encephaloid, and forms, in fact, merely a species of it, it does not seem to me to be entitled to separate consideration. Of scirrhus, properly so termed, I have never seen an instance in this organ, and question whether there is a perfectly reliable case of it on record, notwithstanding all that has been said respecting it.

1. *Encephaloid*.—Encephaloid generally occurs in children from the second to the tenth year; I have seen it several times within less than six months after birth; and cases are occasionally met with of its occurrence rather late in life. The oldest patient in whom I have observed it was forty-two years of age. Both sexes are liable to it, but males probably suffer more frequently than females. Of the influence of temperament in the production of encephaloid of the eye nothing is known.

The disease always begins in the very depths of the eye, generally in the retina or choroid, from which, as it proceeds, it gradually extends to the other structures, until, at length, they are involved in one confused and disorganized mass. The earliest symptom is generally a yellowish, amber, golden, or buff colored spot, far back in the organ, which, upon inspection, is found to look very much like the eye of a cat. This spot rapidly increases in volume, but finally entirely disappears, being replaced by dark matter; the pupil, at first sluggish, becomes permanently dilated and insensible to light; the lens is thrust forwards against the iris; and the anterior chamber is completely obliterated. The eye, enlarged in every direction, presents a distorted appearance; and the cornea at length giving way, a fungous, cauliflower-looking mass is formed, which, projecting beyond the lids, soon becomes

the seat of a copious, sanious, and fetid discharge, and a source of frequent and abundant hemorrhage. The patient now experiences a

Fig. 219.



great deal of pain, the lymphatic ganglions in front of the ear take on disease, and the constitution evinces all the evidences of the cancerous cachexia. Finally, hectic fever sets in, the body is rapidly emaciated, and death soon follows, from the joint effects of irritation and hemorrhage, the period which intervenes between its occurrence and the commencement of the malady, varying, on an average, from six to nine months. The annexed drawing (fig. 219), from a clinical case, exhibits the ap-

pearances presented by this disease after the occurrence of ulceration.

There is no disease with which it is possible to confound encephaloid; glaucoma and amaurosis bear, it is true, some resemblance to it in its earlier stages, but any doubt upon this subject may usually be dispelled by a thorough inspection of the interior of the eye, with the aid of the ophthalmoscope, which will always reveal the existence of a tumor in the one case, but the entire absence of it in the other. Besides, glaucoma and amaurosis are extremely rare in infancy, especially as simple and independent affections; hence the very fact of there being serious disease, deep in the interior of the eye, is calculated to awaken suspicion as to its malignant character. After the morbid growth had made some progress, its characters are generally too well marked to admit of mistake. The absence of black pigment will always distinguish encephaloid from melanosis.

Encephaloid is always fatal; if removed, however early, it is sure to recur, or show itself elsewhere; if left to itself, it gradually involves the different structures of the orbit, and even the base of the brain and its membranes. The eyelids generally escape, although they are always much enlarged and infiltrated with serosity.

The subjoined account of the dissection of an encephaloid eye is copied from the third edition of my *Elements of Pathological Anatomy*. The patient was forty-two years of age, and the tumor, which was an open, bleeding fungus, projected at least an inch and a half beyond the level of the lids.

The entire mass, after being divested of the muscles and celluloadipose tissues of the orbit, all of which were quite healthy, was nearly three inches in length by five and a quarter in circumference, its weight being a little upwards of two ounces. The eye itself was of the ordinary form and volume, but was considerably thrown out of its position by the morbid growth, which was of an irregularly oval shape,

and sprung from the inner side of the sclerotica, near its junction with the cornea. This connection, however, was rather apparent than real; for, on tracing the heterologous mass, it became evident that it had originated in the retina, which had itself almost disappeared. The anterior surface was closely invested by the conjunctiva, which had a rough, fleecy aspect, from the morbid enlargement of its villousities: about its centre was an incrusted ulcer, three fourths of an inch in diameter, around which the parts were somewhat knobby, and of a bluish, livid color. On cutting through this portion of the tumor, it was found to consist essentially of vessels, some of which had been opened by the erosive process, and formed the source of the frequent hemorrhages with which the patient had latterly been affected. Posteriorly the mass was of a much lighter complexion, as well as more soft, and exhibited that peculiar tuberoid arrangement so characteristic of encephaloid.

The cornea, although still transparent, was considerably diminished in size, and adhered firmly to the iris. The sclerotica was of the natural thickness, extensively attached to the choroid, and of a yellowish buff color. The choroid itself was of a speckled, brownish appearance; at some points, it was completely disorganized; and, at one part, nearly opposite the morbid growth, there was a thin, black layer of blood beneath it. The retina, as before stated, was almost entirely destroyed; and, in place of the vitreous humor, there was a dense, solid, whitish mass, evidently the result of an effusion of fibrin. The anterior chamber of the eye was obliterated, and the iris transformed into a substance resembling fibro-cartilage. The optic nerve, near its entrance into the sclerotica, was slightly enlarged, bulbous, and pervaded by encephaloid matter. The appearances of the eye are pretty well shown in the annexed sketch (fig. 220), taken from the actual specimen.

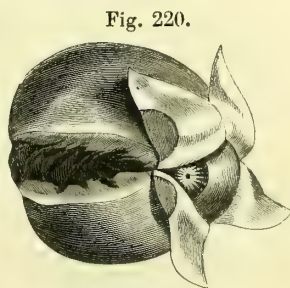


Fig. 220.

Encephaloid of the eye.

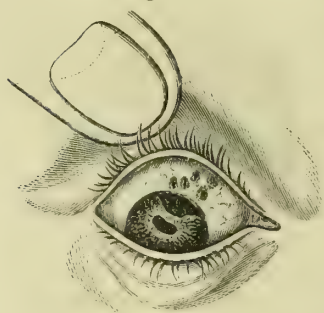
In July, 1857, I removed an encephaloid eye from a little boy, aged two years, in which the morbid mass possessed an extraordinary degree of softness throughout. It had been in progress nearly a twelve-month, had protruded slightly beyond the lids, and had involved all the soft parts of the orbit. The lachrymal gland was remarkably indurated, as well as considerably enlarged; and the crystalline lens, of a yellowish color, and more than twice its natural size, had undergone the earthy degeneration. The encephaloid matter revealed no cancer cells.

2. *Melanosis*.—Melanosis of the eye is much less common than encephaloid, with which it occasionally co-exists. It is generally associated with melanosis in other parts of the body, and is rarely met with before the age of thirty-five or forty. Its starting point is usually deep in the eye, but of its precise origin we have no knowledge, as no opportunities have hitherto been afforded for investigating this ques-



tion, since the disease never proves fatal in its earlier stages. Judging, however, from analogy, and the close resemblance which melanosis bears, in its progress and termination, to encephaloid, it is extremely probable that both products have a similar origin. Be this as it may, the first evidence of melanosis of the eye is the existence of a dark, black, or purple mass deep in the vitreous body, apparently in contact with the retina, and entirely devoid of the metallic lustre, so conspicuous in the other form of malignant disease. The pupil is crippled in its movements, vision is materially impaired, and the eye has lost its natural expression. As the morbid growth extends it gradually disorganizes the humors of the eye, thrusts forward the iris, obliterates the anterior chamber, and causes ulceration of the cornea, or of the cornea and sclerotica, with a consequent fungous protrusion, from which there is always a dark, fetid, and abundant discharge, with occasional slight hemorrhage. In the latter stages of the malady the ball of the eye is generally more or less lobulated, and of a characteristic black color, not uniformly but at different points of its extent, the dark

Fig. 221.



Melanosis of eyeball.

hue strikingly contrasting with the white appearance of the sclerotica. The tumor, which sometimes equals the volume of an orange, generally projects a considerable distance beyond the level of the lids. The appearances of this disease are well seen in fig. 221; the iris has been partially detached, and the mass is making its way through the sclerotica, near the cornea.

The *progress* of melanosis is generally considerably slower than that of encephaloid, but its termination is not the less certainly fatal. The average duration of the disease is from nine to eighteen months. Sometimes a case occurs where it lasts several years. There is seldom

much pain until ulceration sets in, when the suffering rapidly increases, and sadly tells upon the constitution. Lymphatic involvement also now takes place; the disease gradually extends to the structures of the orbit; and death finally occurs from exhaustion, very much as in encephaloid, which it likewise resembles in its disposition to relapse after extirpation.

The only remedy for encephaloid and melanosis is *extirpation*, and that is, unfortunately, too often of a questionable character. If done at all, it should be done early and most thoroughly. If deferred until ulceration has begun, little is to be expected from such a procedure. Under any circumstances, however favorable, relapse is inevitable. Such is certainly the result of my experience, confirmed a thousand times by that of the profession generally. During my pupilage in this city, I saw Professor George McClellan remove this organ in three instances for these affections, and in each there was a reproduction of the malady in less than a month. The patients were children under

nine years of age, and in two the symptoms and progress of the disease were such as to hold out strong inducements for the operation. I have myself extirpated the eye in nine cases, in seven for encephaloid, and in two for melanosis, and in every one, so far as I have been able to judge, I believe that I have done mischief, by hurrying the patient prematurely to the grave. In one instance I performed not less than three operations almost in as many weeks, first removing the ball, and then portions of the lids and neighboring parts, but all to no purpose. The patient died from the effects of the malady in a few months from the time of the first excision. Some years ago I saw a lad, thirteen years of age, upon whom Professor Mussey had already operated twice, with the consequence of a speedy relapse in each instance. When the case fell into my hands, some weeks after the last operation, the morbid growth had already advanced so far as utterly to preclude the propriety of further interference. The youth went home, and died in a few months after.

## EXTIRPATION OF THE GLOBE OF THE EYE.

This operation may become necessary on account of malignant disease of the eye, especially encephaloid and melanosis. It is sufficiently easy of execution, but as it is liable to be attended by copious hemorrhage, it should not be undertaken without proper precaution.

The patient being under the influence of chloroform, and the head firmly secured upon a low pillow, an incision is made from the outer canthus towards the temple, with a view of facilitating the remaining steps of the operation. The length of this incision need not exceed three-quarters of an inch. The tumor being transfixed by a double hook, or by a double ligature, the knife, a narrow and rather a sharp-pointed bistoury, is passed circularly around it, dividing the conjunctiva, and thus separating the morbid mass from the lids. The next step is to cut the muscles of the eye a short distance behind their tendinous attachments, and finally to divide the optic nerve a few lines from its entrance into the sclerotica. Should the disease, however, be of long standing, then, instead of this procedure, which is always very simple, it will be necessary to include in the dissection, all the soft structures of the orbit—muscles, cellulo-adipose matter, and lachrymal gland—sometimes, indeed, even the periosteum itself, and the nerve as far back as possible. The deep dissection will be much facilitated by the use of the scissors and a pair of slender dressing-forceps. The blood, which often flows in torrents, is wiped away with a sponge mop, and when the operation is over, the cavity is stuffed with lint wet with a saturated solution of alum, a thin compress moistened with sweet oil being placed upon the lids and gently supported by a bandage. This effectually prevents further hemorrhage. Clearance of the orbit is not attempted until the establishment of the suppurative process.

## DISEASES AND INJURIES OF THE LACHRYMAL APPARATUS.

The lachrymal organs consist of the lachrymal gland, canals, and sac, together with the nasal duct, which are all liable to inflammation and its effects, and also to some of the heterologous formations, either as primary or secondary affections.

*a. Lachrymal Gland.*—The principal affections of this little body are inflammation, encysted tumors, and chronic enlargement.

1. Inflammation of the lachrymal gland, technically called *dacryadenitis*, is so very rare that many practitioners have doubted, though erroneously, the possibility of its occurrence. It is mostly seen in young subjects, of a strumous diathesis, and is commonly produced by the effects of cold or external injury; in disease of the globe and orbit the gland is sometimes involved secondarily, and this, in fact, appears to be the way in which it usually suffers, idiopathic disease being exceedingly infrequent. There are no signs by which the affection can be discriminated from other maladies in its immediate vicinity; but its presence may always be suspected when there is pain, more or less severe, in the situation of the gland, accompanied with swelling and tenderness on pressure. Confirmatory evidence is afforded by the absence of lachrymal secretion, or the existence of inordinate dryness of the conjunctiva, œdema, pain and tension of the upper lid, and displacement of the ball of the eye, which is generally pushed somewhat downwards and inwards by the pressure of the enlarged gland, as well as embarrassed in its movements. The conjunctiva always participates in the inflammation, becoming red and painful; the periosteum of the orbit is also liable to become involved, and the bone itself may ultimately be attacked. Fever and headache are among the more common symptoms, and in many cases the patient is delirious.

Dacryadenitis may terminate in abscess, or pass into the chronic form, the gland remaining enlarged and tender for many months. The formation of matter is usually indicated by the occurrence of delirium, or an increase of it if it previously existed, a disposition to rigors, and aggravation of the circumorbital inflammation.

The *treatment* is rigidly antiphlogistic; by general bleeding if there be much suffering conjoined with plethora; by leeches to the outer part of the upper lid, forehead, and temple; by active purgation; by the use of the antimonial and saline mixture; and by the application of medicated dressings, either in the form of light poultices or fomentations. If suppuration occur, the matter is evacuated by an early incision through the upper part of the conjunctiva, beneath the corresponding lid. The chronic form of the disease is combated by milder means; principally by purgatives, occasional leeching, and alterant tonics. Now and then the puncture made for the evacuation of the abscess is disposed to remain fistulous; when this is the case it must be lightly touched, from time to time, with nitrate of silver, or the end of a fine probe, dipped in a weak solution of acid nitrate of mercury.

2. An *encysted tumor* occasionally forms in the lachrymal gland, in



consequence, apparently, of the obstruction of one of the lachrymal ducts, and the retention of lachrymal fluid. The contents of the cyst are of a whitish color, of a thin, watery consistence, and decidedly saline to the taste; occasionally they are thick and viscid, like synovia. The tumor varies in volume from that of a pea to that of an almond; it is irregular in shape, and bears the closest resemblance, in its appearance, to a small bladder; it consists of a single layer, and is always unilocular. In the few cases in which it has hitherto been observed it occurred in young subjects, under thirty years of age. The diagnosis of the affection is necessarily obscure, if not altogether uncertain. When the tumor approaches the surface, and has an elastic, or semi-elastic feel, an exploring needle, carefully inserted, may assist us in determining the nature of the case; but, in general, this can be done only by an incision, large enough to expose its surface. The eyeball is usually displaced forwards and inwards, but as this protrusion may be caused by other affections, such, for instance, as tumors of the orbit, entirely unconnected with this gland, it is evident that we can deduce no useful hints from that circumstance.

The *treatment* is conducted upon the same principles as that of encysted tumors elsewhere. The safest remedy is an injection of a very weak solution of iodine, or the introduction of a little mercurial ointment, to excite inflammation and an effusion of plasma. Extirpation of the sac should only be attempted when the tumor is large and indisposed to yield to other and milder means.

3. The lachrymal gland is liable to *chronic enlargement*, producing a condition of parts similar to what occurs under similar circumstances in the tonsils, the lymphatic ganglions, and the mammary gland. Ophthalmic writers have much to say about this affection, many of them confounding it with true scirrhus, a disease which is probably never developed in this organ. What countenances this opinion is, first, that the enlargement and induration often take place in young subjects, long before the period for the appearance of scirrhus in other situations; and secondly, that dissection, however carefully conducted, always fails to disclose the characteristic structure of this heterologous product. Still, I do not feel inclined altogether to deny the possibility of the occurrence of scirrhus, much less of encephaloid, in this gland; for it is unquestionable that, in not a few of the reported cases, the enlargement of this organ was carried to a prodigious extent; far, indeed, beyond what we might suppose would have happened had the disease been of a benign nature. Moreover, it is certain that the gland is liable to become affected secondarily by cancer, as is seen in encephaloid of the globe of the eye, and in epithelioma of the lids and orbit. We must, therefore, be in doubt respecting the real nature of these tumors. It will be a good rule to extirpate them without delay, whenever they are at all of a suspicious character, or whenever it is found that they are not amenable to the ordinary discutient means.

4. *Extirpation* of this body is accomplished by making an incision through the outer commissure of the lids, and raising the upper flap from the corresponding portion of the ball; a procedure altogether preferable to cutting through the substance of the lid as generally ad-

vised by surgeons. The enlarged gland being thus exposed is carefully liberated with the finger or handle of the scalpel, and lifted from its bed along with any other suspicious looking structure. The edges of the cutaneous wound being approximated by suture, a light compress is placed upon the eye, and confined by adhesive strips.

*b. Lachrymal Canals.*—These little passages, which convey the lachrymal secretion to the tear-bag, are liable to inflammation, obstruction, and stricture. The inflammation, whether originating in the canals themselves, or propagated to them from the neighboring structures, is attended with thickening of the lining membrane, more or less uneasiness, muco-purulent discharge, and watering of the eye, the tears being unable to reach their natural destination. The subjects of the disease are generally persons of a strumous predisposition, who are very prone to take cold, and to suffer from other ophthalmic affections, especially chronic conjunctivitis. Indeed, we seldom meet with inflammation of these canals without this association. The proper remedies are attention to the general health, which is often much impaired, and gentle, but steady purgation, with a leech occasionally to the inner canthus, and the use of slightly astringent injections.

Obstruction of these canals may be caused in different ways; most generally by chronic thickening of their lining membrane, sometimes by the presence of inspissated mucus, or muco-fibrinous matter, sometimes by earthy concretions, and sometimes, again, by direct adhesion of their walls, or by deposits of lymph in the submucous cellular tissue. The closure may be partial or complete, temporary or permanent; in some cases it affects merely the puncta, or orifices of the tubes. The characteristic symptom is epiphora; but the nature and situation of the obstruction can be determined only by an examination with the probe.

When the obstruction is extensive, or dependent upon firm adhesions, or the presence of organized lymph, no benefit will be likely to result from treatment; under opposite circumstances, relief should be attempted by gradual dilatation, and mildly astringent injections, the proper instruments for performing these operations being Anel's probe and syringe, depicted in the annexed cuts (figs. 222 and 223).

Fig. 222.

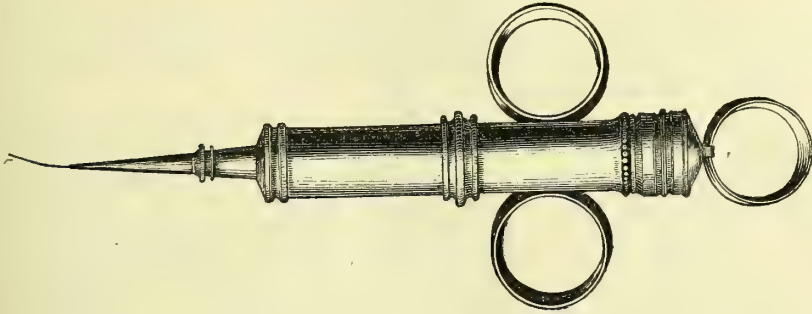
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Anel's probe.

Great tact and caution are necessary in the use of these instruments, otherwise we shall be apt to increase the disease instead of diminishing it. The probe should not, at first, be introduced oftener than once every fourth or fifth day, and the operation should never be commenced without some preliminary treatment, with a view of rendering the parts more tolerant of manipulation. The eye should always be well bathed immediately before, and for some time after the passage of the instrument, and if considerable irritation arise, a brisk purgative must be given, and a leech applied to the inner canthus. The dilatation may generally be greatly promoted by the daily use of some

astringent injection, composed, for instance, of the eighth of a grain of nitrate of silver to the ounce of water, or a weak solution of zinc,

Fig. 223.



Anel's syringe.

alum, or lead. Without, however, some constitutional treatment, I am satisfied that local measures will generally afford very little benefit; and even then, under the most favorable circumstances, much time and patience will be required to effect a permanent cure in any case.

*c. Lachrymal Sac.*—The tear-bag is liable to inflammation, both acute and chronic, abscess, and fistule.

1. Inflammation of the lachrymal sac, the *dacryocystitis* of the ophthalmologist, commonly occurs in strumous and syphilitic subjects, either from exposure to cold, disease of the neighboring structures, or, as more generally happens, from obstruction of the nasal canal, the inferior outlet of the sac. The sac, under these circumstances, is placed in the same condition as the urinary bladder in stricture of the urethra, or chronic enlargement of the prostate gland. In either event there is retention of the natural contents of the reservoir, which, undergoing chemical decomposition, become thereby a source of inflammation, suppuration, and even ulceration. I imagine that most of the more simple cases of dacryocystitis are induced in this way. The disease may occur at any period of life, but is uncommon in infancy and childhood.

The acute form of the disease is characterized by unusual violence, the *symptoms*, both local and constitutional, being generally much more severe than the size and importance of the affected part would seem to justify. The reason, however, is sufficiently apparent when we reflect upon the organization of the sac, and the nature of the structures which surround it. The disease begins in the form of a hard, circumscribed swelling, just below the tendon of the orbicular muscle, which, gradually increasing in size, soon becomes the seat of the most exquisite pain, deep-seated, tensive, throbbing, and extending about in different directions; the skin has a red, erysipelatous look, and slightly pits on pressure; the eyelids, cheek, and nose, are deeply involved in the morbid action; the lachrymal canals being obstructed, no longer perform their office; there is high fever, with agonizing headache; and the patient is often violently delirious. If the excite-



ment be not arrested, as it rarely will be when it has attained this height, suppuration will set in, thus greatly augmenting the suffering.

The *treatment* of acute dacryocystitis is rigidly antiphlogistic. Leeching, and even venesection may be necessary; purgatives and antimonial are freely used, along with anodynes, to allay pain and promote sleep; and the parts, painted several times a day with dilute tincture of iodine, are kept constantly wet with a strong solution of acetate of lead and opium.

2. The formation of *abscess* of the lachrymal sac is denoted by the pointed character of the swelling, by the erysipelatous blush of the skin, by the throbbing nature of the pain, and by the sense of fluctuation, which is always present when the matter has made some progress towards the surface. In that case, too, there is often a small vesicle of the epidermis with an attenuated state of the skin, showing where the abscess, if left to itself, will ultimately open. The treatment of the disease is, obviously, by incision, large enough to afford free vent to the pent-up fluid, and the earlier the operation is performed the better, both for the part and system. The tendon of the orbicular muscle, made tense, serves as a guide to the knife, which is then carried perpendicularly down over the most prominent part of the swelling. A very small tent is inserted to insure patency of the wound.

The inflammation having subsided, the artificial opening gradually closes, though, in general, it will manifest a disposition to remain patent, especially if there is any obstruction in the nasal canal, or disease of the lachrymal bone, as may happen when the affection is of a strumous or syphilitic origin. In such a case the bone may be completely necrosed, and consequently require removal. When the sac remains open, or breaks at intervals, it discharges more or less pus, or puriform mucus, constituting what has been called *mucocoele*. Under such circumstances, the cure may be promoted by astringent injections, or simply washing out the sac several times a day with tepid water and soap, or common table tea.

3. Chronic *dacryocystitis* is often a troublesome and obstinate disease, as annoying to the practitioner as it is disagreeable to the patient. It may be a sequela of the acute form of the malady, or it may exist as an original lesion, coming on gradually and stealthily, without any evident cause, and unaccompanied by any marked symptoms. It is most common in strumous persons, in consequence of attacks of measles, scarlatina, and smallpox, and frequently lasts for months and years, meanwhile producing serious structural changes, particularly thickening of the lining membrane, and obstruction of the lachrymal and nasal ducts. Sometimes it is dependent upon disease of the pituitary membrane, caries of the bones of the nose, or the presence of a nasal polyp.

The disease is recognized by a small tumor at the side of the nose just below the tendon of the orbicular muscle, and by a constant feeling of uneasiness of the part; there is generally some inflammation of the conjunctiva and lids, and occasionally, though not always, some discoloration of the skin in the situation of the sac. The swelling is

caused by the retention of the tears and the accumulation of the mucous secretion; two circumstances which materially serve to keep up the morbid action. By pressing the tumor gently with the finger, its contents may be made to discharge themselves through the lachrymal canal, and partly, also, through the nasal duct; this, indeed, is the method usually adopted by the patient to obtain temporary relief, the operation being often performed three or four times a day. Epiphora, or watering of the eye, is generally another of the annoyances experienced by persons laboring under this affection.

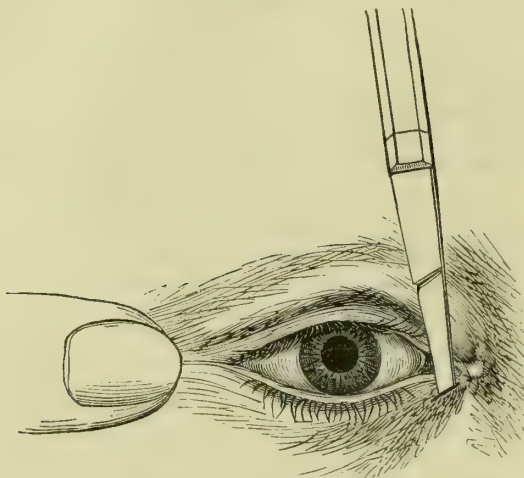
Chronic dacryocystitis is treated upon the same principles as the acute form of the disease, only that our remedies must be plied less vigorously. Attention to the general health is indispensable in all cases; the secretions, which are often much at fault, must be early corrected; the diet must be properly regulated; and the bowels must be kept under the influence of mild purgatives, containing a small quantity of blue mass or calomel. Locally, the best application is a leech, renewed every six or eight days, use being made, in the interval, of the dilute tincture of iodine, painted upon the skin over the sac once every twenty-four hours. Benefit, of a very important character, will accrue from the daily use of mildly astringent injections, thrown into the sac along the lower lachrymal canal with an Anel's syringe. We cannot be too careful, however, in the use of these means, for, should they be at all irritating, we shall be sure to increase the morbid action instead of abating it. The practitioner has a great variety of articles from which to select, and he has only to be careful that he properly graduates their strength to the tolerance of the parts. When the disease is dependent, as it often is, upon partial obstruction of the nasal duct, an attempt should be made to effect clearance with the probe, used upon the same principle as in the corresponding affection of the lachrymal canals.

The introduction of the probe necessarily involves a very thorough acquaintance with the anatomy of the lachrymal passages. The operation is usually performed upon the inferior canal, the patient being seated upon a chair with his head resting against the breast of the surgeon who stands behind him. The lower lid being made slightly tense by placing a finger over the outer commissure, the probe is inserted from above downwards, and gradually brought to a horizontal position, until the point reaches the further side of the sac; the instrument being now raised against the superciliary arch, is passed steadily downwards, with a slight inclination backwards, along the nasal canal, into the inferior chamber of the nose, care being taken to execute the whole proceeding in the gentlest possible manner. The operation is repeated from time to time, at first once every four or five days, then once every other day, and finally once every twenty-four hours, until all necessity for its employment ceases.

Should this plan fail, and abscess be threatened, the sac should be laid open, and a style worn in the nasal duct. The patient being seated upon a chair, with his head supported upon the breast of an assistant, the surgeon, sitting in front of him, stretches the tendon of the orbicular muscle by placing his finger over the outer commissure, and, taking

the tendon as his guide, he plunges a narrow, sharp-pointed bistoury, held, at first, almost horizontally, and then vertically, into the sac, and finishes the operation by bringing the instrument in the vertical position, and cutting from within outwards. The annexed cut (fig. 224)

Fig. 224.



Operation for relieving the nasal duct.

exhibits the manner in which the operation is usually done. A style, made of silver, eight lines long, and represented in the next sketch (fig. 225), is then con-

Fig. 225.

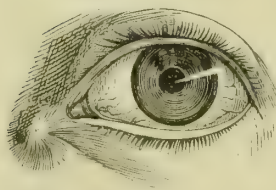


veyed into the nasal duct, its head protruding at the orifice of the wound, where, if there be any danger of its falling into the sac, it may easily be secured by a little thread, passed through an aperture in the instrument, and fastened to the side of the nose with a bit of court plaster. The style is occasionally withdrawn and cleansed. Instead of this instrument the surgeon may use a piece of catgut or unoled sole-leather, or, what I prefer, a bougie of slippery elm, which, while it is easy of introduction, has the effect of rapid expansion, thus greatly expediting the dilatation.

When the duct is firmly closed, it may be necessary, as a preliminary to the insertion of the style or bougie, to effect clearance with a common pocket probe. When the obstruction is irremovable, the proper plan is to drill a suitable opening—a pretty large one—into the lower portion of the lachrymal bone, to allow the tears and mucus to pass into the upper chamber of the nose.

4. *Fistule* of the lachrymal sac is nearly always the result of abscess, dependent upon closure, partial or complete, of the nasal duct. It may, it is true, result from wound, but such an occurrence is quite uncommon.

Fig. 226.



Lachrymal fistule in its chronic stage.

Disease of the lachrymal and turbinated bones, or of the pituitary membrane, and various morbid growths of the nose, may also give rise to it. The external opening is usually situated just below the tendon of the orbicular muscle (fig. 226), and is subject to temporary closure. The discharge is either muco-purulent, or mucous, being of a yellowish or whitish appearance, and of a ropy consistence; the



parts around are generally somewhat tender and inflamed, and the tears often flow over the cheeks, in consequence of the congested condition of the lachrymal passages.

As the cause of this affection is obstruction of the nasal duct, it is evident that the only remedy is its removal. This is to be accomplished in the manner already pointed out under the head of chronic inflammation; but before any measures of this kind are adopted, we should endeavor to get rid of any existing complications, and for this purpose it may be necessary to subject the patient to several weeks' preparation, by leeching, dieting, and purgation. Too much attention cannot, I am satisfied, be paid to this advice, of the benefits of which I have often had the happiest proof in the rapid progress of the treatment. When the patency of the nasal duct has been re-established, the fistule will usually close spontaneously in a few days; should it be slow in healing, the cicatrization may be promoted by the application of nitrate of silver, or a weak solution of acid nitrate of mercury. In several of my cases the orifice closed promptly, after the failure of other means, under the application of a small blister.

5. Having already spoken of the principal diseases of the nasal duct, and the means of overcoming them, in connection with inflammation and fistule, it is not necessary to enter into any formal disquisition of them here. This is the less called for, because they are of infrequent occurrence, most obscure in their diagnosis, and, in great degree, beyond the reach of remedies.

#### DISEASES OF THE LIDS.

The lids are subject to various affections, some of which are peculiar to them, others common to them and other parts of the body. A very cursory survey of these lesions is all that will be necessary in a general treatise on surgery.

a. A *stye* is a small, inflammatory swelling at the edge of the lid, of a furuncular nature, attended with pain, heat, and itching, with a tendency to suppuration. It is, in fact, nothing but a boil, modified by the structure of the parts in which it is developed. The matter is thick, unhealthy, and usually contained in a small slough. The disease probably has its origin in one of the bulbs of the cilia, and is most frequently met with in persons of a strumous constitution, laboring under derangement of the digestive apparatus. I have seen it much oftener in females than in males, particularly in young girls, who take but little exercise, and are subject to irregularity of the menses. Some individuals are peculiarly prone to this disease, suffering almost habitually for months together, one stye appearing after another, or each having a disposition to assume a chronic course. The upper lid is more frequently affected than the lower.

The proper practice is to encourage the suppurative process with warm fomentations, or a light elm poultice, and to puncture the swelling as soon as matter has fairly begun to form. If the stye is very painful, a leech may be applied to its outer surface, and the patient be directed to take a brisk cathartic. When the affection becomes

chronic, or has a tendency to frequent recurrence, special attention must be paid to the correction of functional derangement, by the exhibition of purgatives, alterants, and tonics, and a judicious regulation of the diet. The best local application will be a weak solution of iodine, and slight scarification, to relieve vascular engorgement.

2. Various kinds of *tumors*—horny, warty, sebaceous, encysted, serous, hairy, benign and malignant—form upon the lids, in their substance, or along their free edges; but as they do not differ from similar formations in other regions, it is not necessary that I should enter into any elaborate account of their nature and treatment. Most of them are easily recognized and treated, the proper remedy being excision, performed as soon as the morbid growth acts hinderingly or disfiguringly. Those seated along the edge of the lid may usually be snipped off with the scissors, or, if the patient dreads pain, they may be removed with the ligature; any tendency to reproduction being afterwards repressed with nitrate of silver. When the tumor occupies the substance of the lid, a horizontal incision, embracing the skin and fibres of the orbicular muscle, is made across it, when it may be seized with the tenaculum, and either dissected or dug out, as may be most convenient, care being taken, if it be encysted, not to leave any of the sac behind, nor in any case, to injure the palpebral cartilage. The edges of the wound are approximated by the interrupted suture, which is the only dressing required.

One of the most common tumors in the upper lid—it does not occur in the lower—is the *fatty*, which often attains the size of a currant, in the course of two or three months, and is productive of more or less impediment of motion, as well as of some degree of soreness. It is almost always associated with derangement of the digestive organs, occurs at various periods of life, sometimes even in young children, and generally originates in the cellular tissue between the orbicular muscle and the palpebral cartilage. It is usually somewhat globular in shape, hard to the touch, and unaccompanied by discoloration of the skin. Its pressure sometimes causes partial absorption of the cartilage. Laid open, it is found to consist of a soft, fatty substance, frequently intermixed with a few drops of pus, and contained in an imperfect cyst. The term fatty tumor is the most appropriate one for it. The proper remedy is excision; it never recurs, but similar growths are liable to form in its vicinity. Attention to the constitution is generally necessary to counteract this tendency.

Fig. 227.



Entropion of both lids.

3. Inversion of the lids (fig. 227), the *entropion* of ophthalmologists, is generally the result of severe and protracted inflammation of the eye, attended with excessive intolerance of light, compelling the patient to make constant and powerful efforts to exclude it from the retina. The consequence is that the lids are drawn with great firmness over the ball, not several times during the day, but incessantly, thus induc-

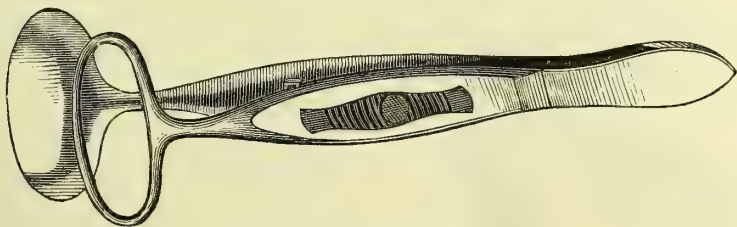
ing relaxation of the skin and orbicular muscle, and, also as a necessary result, inversion of the cilia. Granular and strumous diseases of the eye are, according to my observation, the most common causes of entropion; cases occasionally occur where it is produced by very slight inflammation, especially if, as not unfrequently happens, the individual has naturally a very redundant lid, or a sort of hypertrophous condition of its cutaneous and muscular tissues.

Entropion sometimes affects all the lids, either simultaneously or successively, as I have witnessed in a considerable number of cases; more commonly, however, it is limited to one or two. In degree it varies from the slightest change in the natural position of the organ to the complete curling up of its inner edge, the cilia being perfectly concealed from view. In the advanced stage of the affection the skin of the lid is thrown into numerous horizontal folds, the fibres of the orbicular muscle are spread out and relaxed, the tarsal cartilage is rendered concave in its vertical diameter, and the lashes are stiff and straggling.

The injurious effects which entropion exerts upon the eye may readily be imagined. The lashes, constantly pressed against the anterior part of the ball, fret and irritate the conjunctiva and cornea, keeping up inflammation, with muco-purulent discharge, profuse lachrymation, and intolerance of light. The mischief is particularly apparent in the cornea, which, in consequence of the friction of the lid, soon becomes the seat of plastic deposits, interfering with the transmission of light, and often producing total blindness.

Various remedies have been suggested for the cure of this disease, but the only one which is in the least worthy of reliance is the excision of an elliptical portion of integument, extending from one extremity of the lid to the other, and embracing a few of the fibres of the orbicular muscle. Much judgment is required in order accurately to proportion the amount of substance to be removed; the great danger generally is that the operator takes away too little, thus favoring speedy relapse. Particular instruments, as that, for example, here sketched (fig. 228), have been devised for pinching up the skin and giving the

Fig. 228.



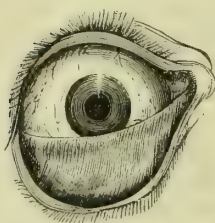
flap a proper shape; but the scientific surgeon needs no such aid, a pair of dissecting forceps and scissors being quite sufficient for his purpose. Excision having been effected, the edges of the wound are neatly tacked together by three or four points of suture, to be removed at the end of the third day. Very little, if any, after-treatment will be re-



quired. If all the lids are inverted they may be operated upon at the same sitting, as I have done in numerous instances.

4. *Ectropion* (fig. 229), the reverse of the above condition, may be caused by long continued inflammation, attended with excessive thick-

Fig. 229.

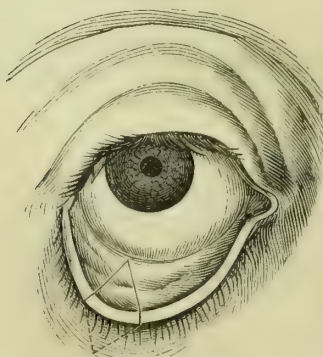


Ectropion of the lower eyelid.

ening of the conjunctiva, as in granular lid; but in the great majority of cases it is produced by the contraction of vicious cicatrices, especially by such as are the result of scalds, burns, and escharotic applications. The eversion presents itself in various degrees, being sometimes very slight, and at other times so great as to turn the lid completely inside out, hanging off from the eye like a shutter. However this may be, it is always accompanied by an inflamed, thickened, and indurated condition of the palpebral conjunctiva, and generally also by more or less disease of the eye, owing to the constant exposure of the ball to light and dust. In cases of long standing the ocular conjunctiva is dry and hypertrophied, and the cornea often exhibits opaque specks, obstructing vision. The affection is most common in the lower lid, and, in its worst forms, is often attended with a remarkable elongation of the part in its horizontal diameter, so that the lid is not only everted but turned away considerably from the ball.

Slight ectropion, depending upon inflammation, may sometimes be relieved solely by antiphlogistic means, which, by promoting the contraction of the enfeebled and relaxed structures, gradually restore the lid to its pristine position. The removal of the thickened and indurated palpebral conjunctiva, in the form of an elliptical fold, sometimes greatly facilitates the cure. When the affection has been caused by a vicious cicatrice, an extensive dissection may be necessary to effect the object, and even then success is by no means always certain, owing to the remarkable reproductive tendency of the inodular tissue. I have, however, repeatedly effected excellent cures by this procedure, in apparently the most unpromising cases. The operation consists in

Fig. 230.



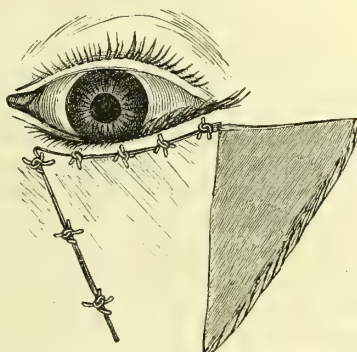
Operation for ectropion.

dissecting up the lid freely from its unnatural attachments, placing a well oiled compress upon the raw surface, and making the part heal by granulation, elevation of the lid being assisted by adhesive plaster, or a thread passed through its edge, and secured to the forehead or cheek, according to the site of operation. If the lid is very large and ill-shaped, it may be necessary to cut out a triangular flap (fig. 230), and a very good cure is sometimes effected, in the more common cases of ectropion, simply by this means.

When the parts are much disfigured,

or partially lost, whether by accident or disease, we may attempt the formation of a new lid, although we cannot flatter ourselves that our efforts will often succeed, especially if serious injury has been sustained by the tarsal cartilage, as in that event it will hardly be possible to obtain a good support for the new organ. The flap may be borrowed from the cheek or temple, or partly from the one and partly from the other. The adjoining cut (fig. 231) affords a good idea of the nature of the operation.

Fig. 231.



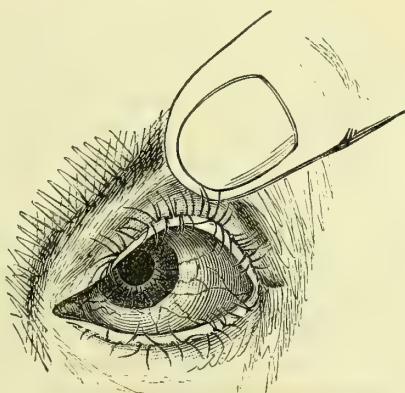
Plastic operation.

5. The lids are sometimes attached by morbid *adhesions* to the ball of the eye, thus not only impeding its movements but causing serious deformity. The most common causes of the occurrence are scalds and burns, and the contact of escharotic substances, as nitric acid and quicklime. The defect is sometimes congenital, though this must be extremely rare, as I have never seen an instance. Relief is attempted by the cautious use of the knife, the contiguous surfaces being afterwards kept apart by soft lint, and by the daily destruction of the new adhesions with the probe. The cure will necessarily be tedious, and require the exercise of a great deal of patience.

6. Inversion of the eyelashes, technically called *trichiasis* (fig. 232), may exist as an independent affection, or as a complication of entropion.

Generally caused by chronic disease of the lids, especially psoriasis and eczema, it sometimes comes on without any assignable cause, and at a period of life so early as almost to induce the belief that it may occasionally be congenital. In some persons the cilia are naturally very short, stiff and straggling, and when this is the case the slightest inversion of the edges of the lids may produce quite a severe trichiasis. The lashes are generally bent in different ways, some towards the eye, some outwards, and some in the direction of the length of the lids. The constant rubbing of the faulty

Fig. 232.



Trichiasis.

cilia against the ball, keeps up serious disease, and often leads to opacity of the cornea, not unfrequently followed by total blindness.

Trichiasis, dependent upon entropion, will generally disappear the moment the lid is put in a condition to resume its proper position. When the cilia alone are inverted, the only feasible remedy is excision

of the part of the lid in which they are implanted, care being taken not to injure the palpebral cartilage; the little wound will soon heal, and no deformity will ensue. When all the cilia are turned in, the procedure which I usually adopt is to include them in two horizontal incisions, extending the whole length of the lid, from one end to the other. Nothing short of this ever answers the purpose, nor will this suffice, unless every bulb is taken away with its corresponding hair. Save the unseemly appearance caused by the absence of the lashes, it is astonishing what little disfigurement such an operation produces.

It has been proposed to cure this affection by inoculating the bulbs of the faulty cilia with dry tartar-emetic, with a view of causing their destruction by the resulting inflammation. I must confess I have an aversion to such a procedure. Evulsion, or drawing out the cilia by their roots with a pair of forceps, is equally objectionable; first, because the process is one of difficulty, and, secondly, because it rarely succeeds.

7. The edges of the lids are liable to an eruptive disease, which is often a source of much suffering, and the characteristic symptom of which is a distressing itching; it is evidently a species of tetter, herpes, or eczema, seated in the orifices of the Meibomian glands, and is generally known by the name of *psorophthalmia*, bestowed upon it by some German author. The affection is almost peculiar to young subjects, of a strumous predisposition, with light hair, eyes, and complexion. When it becomes chronic, as it is wont to do, it is a source of much annoyance, if not positive suffering, keeping the parts constantly sore, itchy, watery, and irritable. Persons thus affected are often unable to read or sew for months and years together. The disease is aggravated by exposure to the light, the use of stimulating food, loss of sleep, and, in short, whatever has a tendency to disturb the secretions or damage the general health.

*Psorophthalmia* is characterized by a reddish appearance of the edges of the lids, by more or less itching, and by the presence of little bran-like scales at the roots of the cilia, accompanied by an inspissated, glutinous secretion of the Meibomian follicles, lachrymation, epiphora, injection of the conjunctiva, and intolerance of light. In the milder forms of the disease, some of these symptoms are either wanting, or they exist only in a slight degree, or they are altogether absent at one time, and present at another. In chronic cases, the edges of the lids, losing their angular shape, are gradually rounded off, and assume a rough, villous, or granular appearance; the mucous membrane is abnormally thickened, the orifices of the lachrymal canals are closed, and many of the lashes drop out for the want of support, or, rather, because of the death of their bulbs. In this stage of the complaint, the affected lid is often considerably everted, and being at the same time very red and watery, it produces that peculiar state, termed *blear eye*.

Regarding this disease as being essentially of constitutional origin, it would be folly to attempt its subjugation by mere topical treatment. Without entering into minutiae, it will be sufficient to remark that a steady and persistent course of purgatives, alterants, and dieting, is indispensable, in almost every case, to a satisfactory and permanent cure. Blue mass and compound extract of colocynth, in five grain doses each,



every fourth or fifth night, will act sufficiently upon the bowels and secretions, without weakening the system; iodide of iron and iodide of potassium will afford a good alterative effect; and bread, vegetables, and milk, will be a suitable diet. Where a tonic is required, great confidence may be placed in the efficacy of iron and quinine, with a very minute quantity of opium and tartar-emetic, with a view to their soothing and alterant effects. Occasionally, a brisk emetic is serviceable, especially when there is marked disorder of the digestive organs.

The most valuable topical remedies are astringent lotions and stimulating unguents, properly diluted, and applied by means of a camel-hair pencil. The article from which I have always derived the greatest benefit is the ointment of the oxide of zinc, in the proportion of one part to six of prepared lard. The ointment of red oxide of mercury, of the nitrate of silver, and of acetate of lead, are also valuable agents. Sometimes the happiest effects follow the application of a weak solution of nitrate of silver in solution. The great secret, in the use of any article, is to make it sufficiently weak not to produce incited action, to apply it not oftener than once, or, at most, twice, in the twenty-four hours, and to bring it fairly in contact with every portion of the diseased surface. To effect the latter object, we should take care previously to remove, by means of a needle, the scaly deposits at the roots of the cilia, as well as any other matter that may have a tendency to interfere with the application. When the lids are very red and tender, poppy fomentations, or an elm poultice, may be necessary. Agglutination of the lids is prevented by the use of a little thick cream at bedtime. In obstinate cases, counter-irritation may be proper.

## PTOSIS.

The term ptosis implies an inability to raise the upper lid, in consequence of some defect on the part of the elevator muscle. This defect may consist in mere atony of the muscle, in paralysis, in mechanical injury, or in hypertrophy of the common integuments. Occasionally it is found to exist as a congenital vice. It is seldom met with simultaneously on both sides. Ptosis varies in degree from the slightest drooping of the lid to its complete closure, and always produces a corresponding defect in the sight, in consequence of the manner in which the affected structures conceal the cornea and pupil.

The *treatment* of this affection must be regulated by the nature of the exciting cause. When it is dependent upon mere weakness of the elevator muscle, the most appropriate remedies will be tonics, as iron and quinine, the shower-bath, stimulating embrocations, and electricity, with change of air.

In the paralytic form, the disease often disappears spontaneously, subsiding with the cause which gave rise to it. In plethoric subjects, general and local depletion, with an occasional purgative, is sometimes necessary, in addition to the use of a small blister to the forehead and eyebrow, the surface being kept raw by means of some irritating unguent. In a case of this variety of ptosis, in a young man of twenty,

which was under my care some years ago, I derived signal benefit, as I supposed, from the repeated application of the moxa, and powerful vesication of the occipito-cervical region. When the affection is dependent upon lesion of the brain, no treatment, however skilfully directed, will be of any avail.

Ptosis from hypertrophy is relieved by the excision of a portion of the redundant integument, in the form of an ellipsis, the edges of the wound being afterwards approximated by several points of suture. The operation is performed in the same manner as in entropion, and great judgment is generally required to determine the amount of substance to be removed.

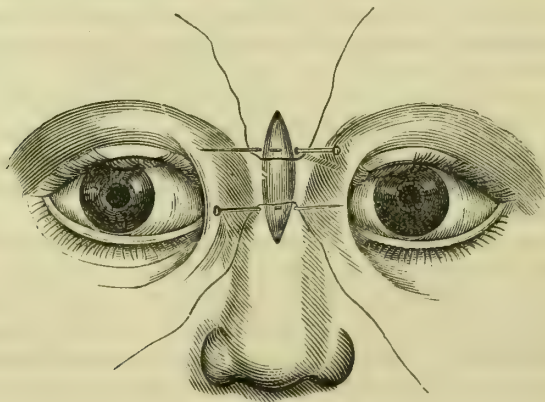
In the traumatic form, the difficulty depends upon the division of the fibres of the elevator muscle, and their consequent separation from each other, as happens, for instance, after the operation for strabismus. To afford relief, it has been proposed to cut out an elliptical portion of the integuments of the lid, and to tack together the orbicular and occipito-frontal muscles, so as to enable the latter, by the hold thus acquired, to counteract, in some degree, the action of the former. The procedure has been employed with marked success in several instances, and is worthy of further trial, though it cannot always be expected to answer the purpose as fully as could be desired. A similar plan may be adopted in the congenital variety of ptosis.

When the affection is irremediable, or while the proper remedies are being used for its cure, temporary relief from obstruction to vision may be afforded by holding the affected lid out of the way with a piece of adhesive plaster, or by means of a small blunt hook, attached to a pair of spectacles.

#### EPICANTHUS.

A very unseemly expression is sometimes imparted to the eyes by the projection over them of a redundant portion of integument at the root of the nose, concealing the lachrymal caruncle and the inner part of the globe. It is always congenital, and occasionally exists in

Fig. 233.



such a degree as to interfere materially with the opening of the lids, if not also with vision. Sichel and others have seen cases where it was hereditary.

The treatment of epicanthus is entirely limited to the excision of the central portion of the redundant integument, in the form of an elliptical flap, the edges of the wound being afterwards approximated by the twisted suture. The result, however, is seldom satisfactory, owing to the tendency of the skin to stretch and elongate itself. In a case which I had at the College Clinic in 1858, in a little girl, about seven years of age, little, if any, permanent benefit accrued, notwithstanding the removal of a very large flap. The character of the operation and the appearances of the affection are depicted in the preceding cut (fig. 233).

#### STRABISMUS.

Strabismus, or squint, as it is termed in common parlance, is an aberration of the optic axes from their natural direction, by which the consent between the eyes is destroyed, and vision is more or less impaired. The resulting deformity varies in different cases, from the slightest deviation to the most disagreeable obliquity. The affected organ may be turned inwards or outwards, upwards or downwards, according to the muscle upon the derangement of which the squint depends. When it is inclined inwards, it constitutes what is called convergent strabismus; if, on the other hand, it is directed outwards, it is said to be divergent. The upward and downward obliquities have not received any particular names.

The most common form, by far, of strabismus is the *convergent*, in which the eye is directed inwards, or inwards and upwards. The degree of obliquity may be very slight, or so great that when the person looks directly forward with the sound eye, the cornea of the other shall be almost completely buried at the inner canthus. The organ, in this variety of the complaint, often inclines a little upwards, but hardly ever downwards. Divergent strabismus is comparatively rare; and the two other forms are almost unknown as separate and independent affections.

There are few cases of strabismus in which *both eyes* are not implicated, though not in an equal degree. Usually one is more affected than the other, which the patient, therefore, always considers as his good eye, as it is the one which he habitually employs in viewing objects. It rarely happens, however, that both organs become deranged simultaneously; on the contrary, one generally squints first, and, after awhile, the other, the interval between the two occurrences being probably very short.

The exciting *causes* of strabismus are various. One of the most frequent is the habit of imitation. Nearly a seventh of all the cases that occur are probably thus induced. Hence, school-rooms are a fruitful source of mischief in this respect, one cross-eyed child being often the cause of strabismus in many others, simply from that practice of imitation so common in young persons. Ophthalmia, however induced, is



another, and also a very common cause of the disorder, as the experience of every one can testify. Convulsions, eruptive diseases, as measles, scarlet fever, and smallpox, whooping-cough, derangement of the digestive organs, injuries of the head and eyes, difficult dentition, and looking fixedly at particular objects, may all be mentioned as so many exciting causes of the affection. Not unfrequently it comes on without any assignable reason, and in persons in the enjoyment apparently of the most perfect health. I have witnessed examples in which strabismus was congenital, and on several occasions I have known it to occur in from three to five members of the same family. There is no evidence that the complaint is hereditary. It occurs in both sexes, and in both eyes, but whether with equal frequency or not, has not been decided. Young persons are most liable to it.

Strabismus essentially consists in a permanent contraction of one of the straight muscles of the eye; of the internal, as was before stated, more frequently than any other. The shortening thus produced varies according to the extent of the squint, and is always accompanied by a corresponding elongation of the opposite muscle, so that it gradually loses, either wholly or in part, its antagonizing influence. The affected muscle is not only broader and thicker than the rest, but also of a deeper color; in a word, it is hypertrophied, in accordance with a law of the economy that, in proportion as an organ is exercised, so will be its size and strength. In the few dissections which I have made of persons who died while laboring under this complaint, this condition was too manifest to escape notice, and it coincides precisely with what has been observed by others in similar cases. Of the immediate cause of strabismus we are ignorant, but the probability is that it is owing to some perverted action of the nerves which supply the muscles of the eye, rather than to any actual lesion of these muscles themselves.

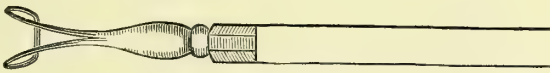
One of the most disagreeable *effects* of this disorder is the deformity which accompanies it, and which renders the individual an object of frequent remark and ridicule. Were this confined to infancy and childhood, no evil would flow from it; but when it is remembered that it continues through life, and that it is a source of constant annoyance and mortification, the influence which it exerts upon the temper of the sufferer must often be most unhappy. But there is another effect, still more deplorable, and this is the impairment of the vision of the affected eye. This defect, which is never entirely absent, always varies with the extent of the deformity, and the length of time that has elapsed since its occurrence. In some instances, especially in those of long standing, the sight is altogether destroyed, the retina being as insensible as in amaurosis. In another series of cases, the person is myopic, or sees objects only at a short distance. In a third series, the vision is, perhaps, double, or objects appear indistinct, or run into each other, the image painted on the retina being confused and imperfect.

It is well known that strabismus has no tendency to spontaneous cure; on the contrary, it generally manifests a disposition to increase, especially in children of a nervous, excitable temperament; and the question, therefore, arises, at what period ought the surgeon to inter-

ferre? My opinion is that the operation should be performed early; but, in coming to a conclusion on the subject, we should carefully weigh the circumstances of each case, as the condition of the patient, and the nature of the exciting cause of the complaint. If the child is otherwise healthy; if there has been no cerebral disease; and if the squint is fully formed, there should be no hesitancy about a resort to the knife. There are valid reasons for this procedure. In the first place, the longer the deformity is permitted to persist, the greater will be the probability that both eyes will ultimately require operation; secondly, as long as the deformity remains, the subject of it will be an object of remark and ridicule; and, thirdly, the invariable tendency of the affected eye is to become weaker and weaker, in proportion to its want of exercise. Besides, children bear such operations always well; they are unattended with hemorrhage and shock; and chloroform is always at hand to insure the requisite quietude during their performance.

The *instruments* which I employ in this operation are a speculum, or lid-holder, a double, sharp-pointed hook for fixing the eye, a pair of forceps, for pinching up the conjunctiva, and a pair of scissors for dividing this membrane, the ocular fascia, and the affected muscle. The lid-holder (fig. 234) is about five inches and a half long, quite

Fig. 234.



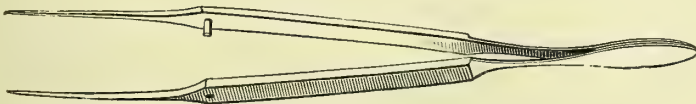
delicate, and curved at the extremity, which is perfectly smooth and polished, and being constructed after the manner of a fenestrated speculum, is not more than four lines wide. The hook for steadying the eye is easily understood by the annexed drawing (fig. 235). It is

Fig. 235.



about five inches in length, and is furnished with a movable slide, so as to admit of the proper separation of the branches, each of which, being two lines in width, terminates in a short prong as delicate as the finest needle. The forceps (fig. 236), a toothed one, should also be

Fig. 236.



rather small; and the scissors should be long, slender, and narrow at the extremity. No knife is necessary.

If the patient is a child, or a timid adult, chloroform is given; the

body is placed recumbent upon a lounge, or table, the head lying horizontally, and the sound eye being protected with a thin handkerchief. Only two assistants are necessary; one of whom, standing at the head of the patient, elevates the upper lid, and holds the eye by inserting the sharp hook into the sclerotic coat, about the eighth of an inch behind the cornea; the branches should be separated about two lines, and the intervening space should correspond accurately with the horizontal diameter of the eye. This precaution should never be neglected, otherwise it will not be so easy to find the affected muscle. The points of the hook should be fairly implanted into the sclerotic coat, but no more. The other assistant, placed on the side of the affected eye, depresses the lower lid, and takes charge of the little sponge. The operator now pinches up a small fold of the conjunctiva, immediately behind the hook and divides it perpendicularly with the scissors (fig. 237); he then cuts in the same direction the ocular fascia, or the submucous cellular substance, and, finally, the internal straight muscle, the latter being severed near its point of insertion into the sclerotic coat. The moment this is accomplished, the eye, from the traction exerted upon it by the hook, springs towards the nose, and the muscle retracts within its sheath, especially if it has been thoroughly liberated from its connections. To effect this, which is a matter

Fig. 237.



Plan of the eye, showing the line of incision in the conjunctiva.

of paramount importance, the scissors should be carried some distance round the eye, occasionally, indeed, nearly as far as the margins of the adjacent straight muscles. The eye will now generally move about freely in its socket, in perfect harmony with its fellow. Should this, however, not be the case, a careful search should be instituted with the curved probe (fig. 238), with a view of ascertaining the cause of

Fig. 238.



the difficulty, which will usually be found to be an imperfect division of the muscle, or of some of the fibrous bands extending from it to the sclerotic coat. Sometimes the obliquity continues without any assignable cause, though rarely beyond a few hours.

The operation being completed, the eye is bathed in cold water, to free it of blood, and the patient is confined for a few days in a dark chamber. Light diet is enjoined, and, if inflammation arise, recourse is had to antiphlogistic measures. The pain and nervous symptoms which occasionally supervene upon the operation, are best combated with anodynes. Considerable ecchymosis sometimes follows the inci-



sions, but requires no particular treatment, as it usually disappears spontaneously in a short time. Suppuration is hardly to be looked for in any case; the occurrence implies improper violence, which cannot be too much condemned. For four or five weeks after the patient leaves his room he should protect the eyes with a green shade, and avoid reading, writing, and, in short, every other occupation calculated to injure his sight. Premature use and exposure of the eyes cannot be too much deprecated, as they tend not only to produce inflammation, but also to jeopard the success of the operation.

Soon after the operation is over, the surface of the wound becomes coated with plastic matter, which thus lays the foundation of the granulating process by which the parts are ultimately repaired. The period required for the completion of the cicatrization varies from three to six weeks. Generally it is retarded by the formation of fungous matter, which springs up at the site of the incision, and requires to be snipped off with the scissors; a proceeding far preferable to the application of nitrate of silver, which is not only much more painful, but far less effectual. The extremity of the divided muscle contracts new adhesions to the ball of the eye, and thus aids in maintaining its parallelism after the cure is completed.

I cannot approve of the practice, recommended by some surgeons, of making the patient turn the eye outwards as soon as he has recovered from the more immediate effects of the operation, for the purpose of causing it to regain its natural position in the orbit. In my earlier cases, before I had devoted much attention to the subject, I adopted this advice, but the result uniformly disappointed me. I have, therefore, long since abandoned it, persuaded that it is founded on erroneous principles. When the eye still retains some degree of obliquity after the operation, it may positively be assumed that there has been imperfect section of the affected muscle, or of the fibrous cords connected with it. How, then, when this is the case, can we expect success? Again, the eye operated on may be perfectly straight, and yet not move in concert with its fellow. Such a result is by no means uncommon, especially in the more ancient forms of the complaint, and hence the proper rule, in such an event, is to divide at once the corresponding muscle of the other eye. In children, and in cases generally of recent standing, one operation is usually quite sufficient, even when the obliquity remains for some time after. Indeed, the greatest caution should be employed even in the division of one muscle, lest the eye be permanently inclined outwards, and so the distortion be reproduced in the opposite direction.

The principal causes of *failure* after this operation are: first, as already stated, the imperfect division of the affected muscle and fascia; secondly, excision of a portion of the conjunctiva, eventuating in undue contraction of this membrane during the process of cicatrization; thirdly, premature exercise and exposure of the eye; fourthly, the co-existence of epilepsy, hydrocephalus, and other cerebral diseases; fifthly, readherence of the muscle to an unfavorable point of the sclerotic coat, by which it is again enabled to exert a prejudicial influence over the movements of the ball; and, finally, the fact that

only one operation is performed, when it is certain that both organs are affected nearly in an equal degree. Of all these causes the first and last are, I have reason to believe, the most frequent and efficient. Very recently, I had under my care a youth on whom I operated for double strabismus, whose eyes have become slightly everted from the want of accurate union of the edges of the wound, the sclerotica exhibiting its characteristic white appearance at the bottom of the incision.

The *effect* of the operation upon vision is at first rather disagreeable than otherwise; at least in some cases. It is only by degrees that the eye regains its functions; and occasionally, whether from long disuse of the retina, or from other causes, little or no improvement of this kind is to be looked for. Another unpleasant effect, but not a very common one, is double vision, which is evidently due to a want of consonance between the optic axes, and rarely continues beyond a few days. Finally, we must not forget to mention the peculiar prominence of the eye after this operation. This is generally well marked in every instance, and imparts to the organ a full, bold, disagreeable expression; it is accompanied by a considerable separation of the lids, and is caused by the liberation of the eye from its confined position.

The operation for strabismus is performed much less frequently now than it was ten years ago; chiefly because it has fallen somewhat into discredit from the frequent failures that have attended it in the hands of incompetent men. Every physician, in fact, has considered himself qualified to undertake it, no matter how slender his anatomical knowledge and practical skill. It is not surprising, therefore, that many of the cases that have been subjected to the operation should have disappointed expectation; but these circumstances should not discourage us, or be used to the prejudice of an operation, calculated, when properly executed, to confer so much benefit upon this class of sufferers. The results that have transpired in regard to it are eminently gratifying, and are sufficient to show that the procedure deserves to be ranked among the established resources of surgery.

The *subconjunctival operation* for strabismus has had quite a number of advocates, though it has never come into general use, nor will it, I think, be likely to do so, owing to the greater difficulty of its execution. The chief reasons urged in its behalf are, that it is followed by less inflammation and less prominence of the eye, which is often so disfiguring in the ordinary procedure. Its disadvantages are that it is more troublesome, and that it requires much more care to liberate the affected muscle thoroughly from its connections with the sclerotica, thus jeoparding the result, especially in the hands of an inexperienced surgeon. As to the circumstance of its being productive of less inflammation, I consider that as a matter of very little consequence one way or the other, having never witnessed any bad effects from the ordinary procedure. The operation may be performed with a pair of scissors, or a probe-pointed bistoury, introduced through a small opening in the conjunctiva, and carefully insinuated beneath the affected muscle. Dr. Addinell Hewson, who has published an elaborate paper on Strabismus in the North American Medico-Chirurgical Review for March, 1858, executes the operation with a pair of curved scissors,

furnished with a sliding blade, terminating in a sharp point. The blunt blade being passed beneath the muscle, the other is pushed on over its outer surface, when its division is effected simply by closing the instrument. A preliminary incision, horizontal, and a quarter of an inch in length, is made just below the inferior border of the muscle.

## AFFECTIONS OF THE ORBIT.

The orbit is subject to various affections, seated either in its bony walls, their fibrous covering, or the cellulo-adipose tissue. These affections, however, do not differ materially, if at all, from similar lesions in other parts of the body. One of their most disagreeable effects is that which arises from the pressure which they exert upon the ball of the eye, thereby thrusting it out of its natural position, and at the same time endangering its structure and functions.

*Caries* and necrosis of the walls of the orbit are observed chiefly in tertiary syphilis; I have met with several cases of the kind, and have invariably found them troublesome and tedious.

*Abscess* of the orbit is uncommon. It may arise from disease of the bone, or as a consequence of erysipelatous inflammation of the cellulo-adipose substance. The symptoms are of the phlegmonous kind, and relief must be afforded by early evacuation.

Among the more common forms of *tumors* of the orbit are the fatty, encysted, and encephaloid. A few instances have been observed in which it was the seat of melanosis and hydatids. Exostosis of the orbit is extremely rare. The arterial tumor is occasionally met with, either as a congenital vice, or as a result of hypertrophy; generally the former. It is characterized by its strong pulsation and whizzing noise, and by the atrocious pains which it produces in the eye, head, and face. The ophthalmic artery is sometimes the seat of aneurism.

The *treatment* of these various formations must be conducted upon general principles, or according to the rules laid down for their management in different parts of the work.



## CHAPTER V.

## DISEASES OF THE EAR.

EVERY one familiar with the history of aural surgery must be aware of the great neglect in which this department of the healing art was, until recently, held by the profession. The advances which it has made are by no means equal to those in ophthalmic surgery. There seems, indeed, to be an extraordinary degree of indifference on the part of practitioners and even teachers, in regard to the diseases of the ear. I think I am not wrong when I assert that there is a greater amount of lukewarmness respecting the study of aural surgery than that of any other branch of the science. Most men look upon it as a sort of forbidden ground; as a subject in which they feel no interest, and with which they would rather not have anything to do. The reason of this probably is the intrinsic difficulty with which the subject is invested; the long study which is required to master the anatomy of the ear, the few opportunities which are afforded for investigating its diseases, the trouble which attends this kind of practice, and the want of success which, even in the hands of the most enlightened and scientific, so often follows our best directed efforts. Another reason, doubtless, is the little knowledge that is communicated upon these subjects in the lecture-room and in our surgical treatises. Teachers, both anatomical and surgical, absolutely seem to make it a business to slur over these matters; they talk with great minuteness and flippancy of everything else, however insignificant, but when they come to the ear they either wholly repudiate its claims to consideration, or they pass over it with a sort of railroad velocity, as if to dwell upon it with any degree of care were time entirely misspent. The consequence is that the pupil, upon leaving the lecture-room, knows no more about the structure and diseases of the ear, than he does of any other subject which he has not investigated. Few afterwards make up for this deficiency, and hence such cases of aural surgery as come under their observation must necessarily be neglected, or, worse, maltreated. Hence, too, the reason why this department of practice, so rich and so full of interest, is, everywhere, so much in the hands of the charlatan, who, while he lives upon the credulity of the public, only deludes his victim, who is ever ready, like the drowning man, to grasp at straws.

Such apathy is unquestionably highly reprehensible, if not positively criminal. It is surely our duty to study these diseases, in order that, when we are consulted respecting them, we may be able to treat them with the same confidence and efficiency as any other class of affections that come within the sphere of the general practitioner.

This duty is the more incumbent upon us because of the great frequency of these diseases, and the disastrous results by which they are so often followed. Deafness is no trifling affliction; its existence involves not merely individual happiness, but the happiness often of families and even communities; once established, it lasts not merely for a day, a month, or a year, but as long as the person himself lasts. It is only necessary that we should devote the same amount of study and attention to these diseases that we bestow upon the other branches of surgery, and we shall soon wrest this practice from the hands of the charlatan, and place it upon the exalted footing to which its importance so clearly entitles it.

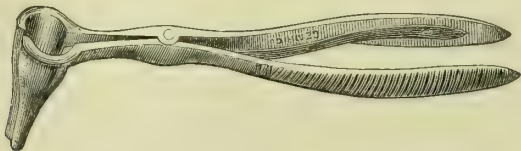
In the chapter which I shall devote to these diseases, a brief outline is all that my space will permit me to attempt. While I shall endeavor to make it as graphic and tangible as possible, I trust that the reader will not rest satisfied until he has exhausted the subject by a thorough study of the valuable works that have appeared upon it in Great Britain, France, and Germany. This country, I am sorry to add, is still without an original production on aural surgery. The most scientific treatise, in my judgment, that has yet been published on the subject is that of Mr. Wilde, of Dublin.

*Mode of Examining the Ear.*—Before I proceed to describe the diseases of the ear, it is important that I should make some remarks upon the proper mode of examining it, with a view to the detection and discrimination of its healthy and morbid conditions; for upon the care with which this is conducted, and the results thereby obtained, must necessarily depend, in great degree, the success of our practice. Few practitioners have either the knowledge or the patience requisite to make a satisfactory exploration, and hence it is not surprising that they know so little respecting their management. Much might be said upon the subject, but all that is really important may be compressed in a few short paragraphs.

In the first place it is necessary, in order to ascertain what the nature of the disease is, that we should have a good light, and it need hardly be added that that afforded by the concentrated rays of the sun is better than any other. A great variety of lamps and reflectors have been devised for illuminating the ear in cloudy weather, or in the night, but of these I never use any, being satisfied that they are all unreliable, as they are calculated to convey erroneous impressions respecting the appearances of the affected structures. The patient being seated upon a chair, with the ear inclined towards the opposite side, facing the sun, the light should be permitted to fall directly upon the tympanal membrane, as can easily be done by pulling the auricle upwards and backwards with the thumb and forefinger of one hand, while the tragus is drawn forwards with the index finger of the other. If the sun be very bright, the examination may be conducted in a room, in front of a large window, but even then I generally prefer making it in the open air, from the fact that transmitted light is never as satisfactory as direct. The surgeon must be careful not to obstruct the passage of the sun's rays with his own head, and he should also see that no one else interferes, as two persons can never

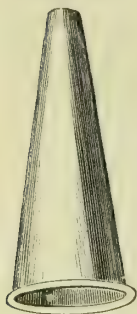
inspect the organ at the same time. A speculum need be used only when the auditory passage is unusually narrow or studded with an uncommonly large number of hairs, obstructing vision. The one which I prefer, and which I have found to answer every purpose for which such an instrument can be employed, is that represented in the annexed cut (fig. 239). It is very light and convenient, and may be

Fig. 239.



adapted to almost any ear, however small, as its terminal extremity is not more than two lines in diameter, while its movable blades readily admit of this distance being increased to any extent compatible with the size of the canal. The speculum invented by Mr. Wilde, and delineated in the next cut (fig. 240), is also an excellent instrument, although I cannot perceive that it possesses any advantages over the other, except its more easy portability. The fact is that these things are very much a matter of conceit or fancy, influenced often by prejudice rather than sound judgment, or the result of correct observation. Be this as it may, I am certain, from much observation, that the eye alone will, in general, be quite sufficient for any examination we may be called upon to make. There are cases, indeed, where the auditory canal is so sensitive as absolutely to prevent the introduction of the speculum, however gently effected. I am sure that every one engaged in aural practice must meet with instances of this description.

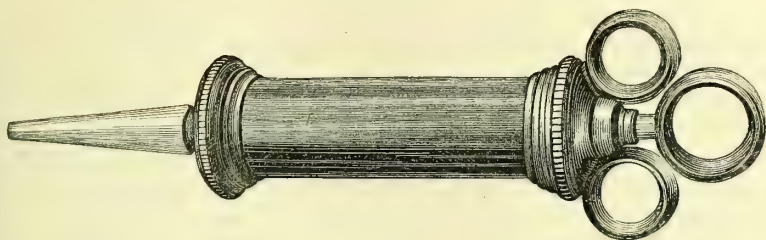
Fig. 240.



While the light is thus playing about in the passage, the examiner takes a rapid survey of the appearances of the parts, noticing particularly the condition of the membrane of the tympanum, as to whether it is transparent or opaque, red, injected, convex or concave, ulcerated, perforated, or destroyed; also the state of the auditory tube, the color and quantity of the cerumen, and, in short, everything else calculated to furnish matter of diagnostic and practical value. Should the parts be obscured, or concealed from view, by the presence of pus, wax, or epithelium and hair, clearance must be effected, as a preliminary step, by syringing the tube with tepid water. A very suitable instrument for this purpose is that depicted in the adjoining sketch (fig. 241). It must be capable of holding at least from two and a half to three ounces of fluid, which should be thrown up with some degree of force, yet at the same time so cautiously as not to shock or pain the affected structures. It should be held firmly in the hand, with the nozzle, which should be inserted only a few lines, directed obliquely downwards and forwards, the water, as it regurgitates from the tube, being received into a large, flattish basin, held



Fig. 241.

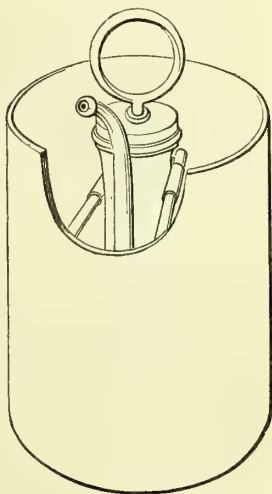


under the patient's ear and chin. A convenient contrivance, combining the arrangement of a basin and syringe, for injecting the ear, was devised by the late Dr. Hullihen, of Wheeling, and is represented in the annexed drawing (fig. 242). The use of the probe is not admissible in these examinations. The forceps or scoop may occasionally be used in the removal of solid matter.

The manner of exploring the Eustachian tube will be described along with the diseases of that passage. A watch held near the ear will determine, by its ticking, perceived by the patient, the degree of hearing. The experiment should be repeated at each visit, and the result carefully noted, as it affords important information relative to the progress of the treatment.

Finally, to render such an examination complete, we must carefully inspect the patient's throat and tonsils, take particular notice of the state of his voice, percuss the mastoid region, and auscultate the ear while air is being forced into it along the Eustachian tube.

Fig. 242.



#### SECT. I.—AFFECTIONS OF THE EXTERNAL EAR.

The auricle is liable to various *malformations*, which are of interest, both in a pathological and surgical point of view. In the first place, it may be entirely absent, either on one or both sides, without any vestige whatever of an external opening. Such a case is not necessarily attended with deafness, although audition must be much impaired. Secondly, there is occasionally an absence of the lobule of the ear; or this structure is divided, by a vertical fissure, into two portions, an anterior and a posterior; or, lastly, it is attached to the side of the head, either partially or completely. Thirdly, there may be a deficiency of the helix, this body being either wanting, or so small and flat as hardly to deserve to be considered as a distinct process. This defect is sometimes congenital, but is much oftener produced, there is reason to be-

lieve, by the pressure of the hat in early life. Fourthly, the tragus and anti-tragus are occasionally bilobed, or divided each into two portions; sometimes they are inverted towards the meatus, thereby partially closing it; and sometimes, again, they are more or less extensively united, particularly along their lower borders, producing a similar effect. Finally, excessive development of the ear may be enumerated as one of its malformations. Last winter, I had a case at the College Clinic, in an infant three months old, of supernumerary ears, in a very rudimentary state, situated immediately in front of the tragus, over the temporo-maxillary joint. In some instances the additional organs occupy the side of the neck.

Some of the above defects admit of remedy by surgical operation; others do not. Thus, a cleft lobule might be readily united by a procedure similar to that for hare-lip; an inverted tragus might be re-trenched or excised; and an abnormal adhesion might be severed by a simple dissection, care being taken, during the healing process, to keep a piece of lint interposed between the raw surfaces. In the case of supernumerary ear, above referred to, no difficulty was experienced in effecting thorough excision.

A wound of the external ear, whatever may be its shape or size, is to be treated upon the same general principles as a wound in any other part of the body. The parts being properly cleansed, the edges are carefully approximated with a needle and fine thread, aided, if necessary, by a few strips of isinglass plaster, which answers much better than ordinary adhesive plaster. A bandage will rarely be necessary, but should it be, it must be applied with great care and gentleness, and with the precaution of filling up the hollow between the ear and head with cotton, wool, or lint. I am aware that some surgeons object to the employment of sutures in the treatment of wounds of the ear; but I have yet to see an instance where they were productive of harm. Without their use, it would be impossible, in almost any case, to make a good cure. Last summer I had under my charge a gentleman, who, in a fall from his carriage, tore away the entire lobule and the parts for some distance above, producing a very ugly wound, several inches in length, which promptly united, in the most beautiful manner, under the use simply of several points of the twisted suture. The dressings, in such cases, should always be pains-taking, any disfigurement here being highly objectionable.

The lobe of the ear is occasionally the seat of a *fibrous tumor*; I have seen four cases of it, all occurring in colored females, in consequence of the perforation of this body, and the wearing of a ring. The youngest of these persons was a child, three years old, who had been subjected to the operation about eighteen months previously. From what I can learn, the growth is much more common in blacks than in whites, and I believe that the exciting cause is nearly always the one here referred to. The tumor is pendulous, of tardy development, insensible, hard, and inelastic, without malignancy, and free from discoloration of the skin, which also retains its normal thickness and pliancy. It is generally somewhat rounded or ovoidal in its shape, and is capable of acquiring a volume equal to that of a hen's egg. In

some cases it is lobulated, or, rather bilobed. A section of it is found to be of a fibrous structure, the fibres intersecting each other in every possible direction; of a whitish color, and of a dense, almost uniform consistence. The remedy is excision, care being taken to save as much integument as possible, in order to prevent deformity. The edges of the wound are carefully approximated by several points of the twisted suture.

## SECT. II.—AFFECTIONS OF THE AUDITORY TUBE.

The auditory tube is liable to malformations, the introduction of foreign bodies, accumulations of wax, polypous growths, and various forms of inflammation.

### *a.* MALFORMATIONS.

The most common malformation of this passage is occlusion of its external orifice by an extension of the common integuments, producing a condition similar to that which we occasionally see in the anus, vagina, and other mucous outlets. A person thus affected is not always deaf, although his hearing must of necessity be very defective. The cutaneous cover may be very thin, consisting, perhaps, merely of a sort of translucent layer, but, in general, it is quite thick and opaque; it may be the only aberration, or it may be associated with absence of the auricle. Such a malformation obviously admits of easy relief. All that is necessary is to make a crucial incision in the situation of the natural orifice, to remove the angles of the wound, and to prevent reunion by the interposition of tents of gradually increasing sizes. But there is another case where relief is either impracticable, or where patency can be established only after much trouble and delay. This is where the occlusion is effected by fibrous, or fibro-cartilaginous, matter, extending some distance down the passage, but not completely obliterating it. Here, only the most cautious and patient attention will be likely to be of any avail. The dissection is made in the direction of the tube, the ear being drawn upwards and backwards during the operation. Reunion is prevented by the steady and protracted use of tents. Of course no operation is attempted where the tube is entirely impervious, or, more properly speaking, where none whatever exists. The use of a delicate exploring needle will be of great assistance in the investigation of these various conditions of the ear.

Finally, children are occasionally born with their ears completely filled with the unctuous matter which covers the skin, and which is probably derived either from the sebaceous follicles, as a depurative secretion, or from the amniotic fluid. However this may be, if the matter be allowed to remain, the deafness, which was at first, perhaps, only partial, may, in time, become complete; or the adventitious substance, acting as a foreign body, excites inflammation, and ultimately leads to destruction of the tympanal membrane. Clearance is effected by means of the syringe and tepid water, aided, if necessary, by the



scoop. A few drops of oil, or glycerine, poured upon the mass, might assist in detaching it.

#### b. FOREIGN BODIES.

Substances of various kinds find their way into the auditory tube, either by accident or design. The most common are grains of corn and coffee, beans, peas, cherry-stones, beads, pebbles, and pellets of paper, wool and cotton. I have met with several cases where the intruders were small bugs and flies. Insects sometimes deposit their larvæ in the ear, being evidently attracted thither by purulent discharges, which, if at all abundant, may afterwards serve as a nidus for the development of the new being. It is surprising that pins, which are so frequently used by females for picking and scratching the ear, do not more frequently drop into the tube than they seem to do.

The effects occasioned by the presence of a foreign body in the ear vary according to its nature, size, and shape. If it be a grain of corn, bean, or similar substance, it will, if retained for a few days, not only expand under the influence of the moisture of the part, but, perhaps, even germinate, thereby causing severe pressure upon the parts in which it is impacted, and increased difficulty in respect to its extraction. No such effect, of course, will follow if the body be of an inorganic nature. Nevertheless, any substance, whatever may be its character, may, by its pressure alone, induce severe pain and inflammation, eventuating in an abundant discharge of matter, excessive constitutional irritation, headache, and delirium. A large substance will, as a general rule, cause more trouble than a small one, a rough than a smooth one, a heavy than a light one, a sharp than a blunt one. A foreign body will occasionally excite ulceration of the membrane of the tympanum, and finally find its way into the middle ear. Such an occurrence, which is fortunately rare, is sure to be followed by severe suffering, if not death. Cases are recorded where violent neuralgia, epilepsy, and mania were induced by the protracted sojourn of an extraneous substance in the ear.

The removal of a foreign body from the ear is by no means always an easy undertaking. The difficulty, generally of itself sufficiently great, is frequently very much enhanced by the tortuous, contracted, or constricted condition of the auditory tube, to say nothing of the pain, tumefaction and discharge which are likely to be present whenever the substance has been for some time retained, and which will always greatly embarrass the proceeding. Various methods may be employed for accomplishing the object, the choice of which must be regulated by the circumstances of each individual case. If the body be relatively small to the size of the tube, and not very rough or heavy, dislodgment may usually be effected with the syringe, charged with tepid water, the fluid being thrown up in a full, steady, and forcible stream, with sufficient care, of course, not to injure the membrane of the tympanum. This procedure should always be employed when the substance lies deeply in the auditory passage; for, although it may not cause its expulsion, it will often bring it within reach, and

thus favor extraction. During the operation, or rather, as a preliminary step to it, the ear should be drawn upwards, outwards, and backwards, so as to efface the angle of the canal. The syringe, which should hold at least two ounces, should have a long, slender nozzle, in order that the current may pass readily by the side of the foreign body.

When the substance is comparatively superficial, it may frequently be seized and extracted without difficulty, the best instrument for this purpose being a pair of very delicate toothed forceps (fig. 243). But

Fig. 243.



such a procedure is not admissible when the substance is smooth, hard, or deep seated; for, in the former case, the instrument will be likely to slip off, and in the latter, it will be impossible to give the blades the requisite degree of expansion for grasping it. If, under such circumstances, the surgeon is determined to succeed, his efforts cannot fail to be productive of serious mischief. The foreign substance will be thrust about in various directions, and perhaps pressed rudely against the membrane of the tympanum, until it is buried in blood, and the patient put in great agony. Cases have occurred where the surgeon, in his anxiety not to be baffled, severely lacerated the auditory tube and even the membrane of the tympanum, causing violent inflammation, followed by death.

The best contrivance, as a general rule, where extrusion cannot be effected by the forceps, or a stream of water, which, however, rarely fails even here, is a small curette, such as is used by the oculist in the extraction of a cataract, or a very delicate probe, a little flat on the surface, and slightly bent at the extremity. This being carefully insinuated between the passage and the intruder, the latter is gently dislodged, the instrument acting either as a lever or a hook, or both, according to circumstances. Fig. 244 represents two instruments

Fig. 244.



which I have devised for facilitating the removal of various kinds of foreign bodies. The extremity of one is shaped somewhat like a corkscrew, and will be found useful when the substance is soft and cannot be seized in any other way.

Children are often brought to us with the ear in a high state of inflammation from previous attempts at extraction. When this is the case, the proper plan is to wait a short time before the attempts are renewed, measures being, meanwhile, employed to subdue the morbid action; as warm anodyne fomentations, the application of a few leeches over the mastoid process, and the administration of a brisk cathartic.

Allusion has already been made to the fact that a foreign body occasionally finds its way into the middle ear, through an opening in the membrane of the tympanum. Under such circumstances, dislodgment will be extremely difficult, if not impossible. Deleau relates a case where, a small pebble having got into this cavity, he succeeded in effecting clearance by throwing warm water into it through the Eustachian tube.

Insects are, in general, easily dislodged with the syringe. It is only when they are of large size, or much spread out, that it may be necessary to remove them with the forceps, hook, or curette. When the proper instrument is not at hand for performing the operation, the insect should be instantly destroyed with olive oil, a mixture of spirits of camphor and water, or tepid soapsuds.

Finally, it is hardly necessary to add that, during the extraction of the foreign body, whatever it may be, the head should be properly supported by an assistant, and resistance counteracted by the use of an anæsthetic agent. Unless this be done, the operation, as was previously stated, will be one of great difficulty, and attended with severe pain, if not serious injury to the parts.

#### c. ACCUMULATIONS OF WAX.

This substance sometimes collects in such quantities in the auditory tube as to produce complete occlusion; at other times, and more generally, the obstruction is only partial, attention being directed to the subject before the accumulation has made much progress. The effect, in either case, is more or less noise in the ear, generally of a buzzing, ringing, or explosive character, and impairment of hearing on the affected side. Occasionally there is complete deafness. This result may depend solely upon the long disuse of the ear from the protracted retention of the secretion, or it may be produced by the pressure of the wax upon the membrane of the tympanum, eventuating in organic disease of its substance, as ulceration, or induration and thickening.

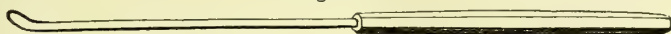
An accumulation of wax does not necessarily imply an inordinate secretion of this substance; on the contrary, it may be deposited unusually sparingly, and yet, owing to its inspissated character, it may proceed until it completely fills the external meatus. Indeed, so long as this secretion retains its natural qualities, and no obstacle is offered to its evacuation, it is very seldom that we find it disposed to remain in the ear; but such an occurrence is very easy when it is deprived of its fluidity, whether in the act of deposition or soon afterwards. However this may be, whenever the wax is long retained it is always remarkably hard and tough, and then often contains a considerable quantity of hair and epidermic scales, the whole forming a dry, almost pulverulent mass, accurately moulded to the auditory tube, excluding the air, and inducing pretty complete deafness. The presence of the substance is generally easily detected by its dark brown or blackish appearance, and by our inability to discover the membrane of the tympanum.

Ear-wax being in great measure soluble in water, the best method



of softening and detaching it is to throw this fluid freely into the auditory tube with a large syringe. The water should always be used warm, and its efficacy will be much increased if it be mixed with a small quantity of soap and ether, which, by combining chemically with the wax, gradually convert it into an oleaginous mass. Many practitioners are in the habit of employing oil for this purpose, but as this substance is destitute of soluble properties, the only way in which it can prove serviceable is by lubricating the walls of the external meatus. When the wax is not very abundant, or too firmly impacted in the tube, I am in the habit of attacking it at once with the spoon-shaped extremity of the common pocket-case director, which, on the whole, is as good an instrument as we can use. Or, instead of this, a curette (fig. 245) may be employed. Care must be taken, in perform-

Fig. 245.



ing the operation, to proceed as gently as possible, picking out piece after piece, until the whole mass has been removed; it being remembered that the long retention of this substance always renders the parts remarkably sensitive. Should any fragments remain at the sides and bottom of the cavity, they may afterwards easily be dislodged with the syringe and tepid water. Clearance having been effected, all that is necessary is to protect the ear, provided it be unusually tender, with a pellet of cotton, to exclude the air, otherwise even this precaution may be dispensed with. When the membrane of the tympanum is very vascular, inflamed, or ulcerated, it will be proper to apply a few leeches over the mastoid process, to cover the ear with cloths wrung out of hot water, and to administer an anodyne diaphoretic. When the tendency to re-accumulation continues, the ear should be frequently syringed, and means taken to check the inordinate action of the ceruminous glands, upon which it depends.

Several remarkable cases are recorded in works on aural surgery of persons who, after having been long deaf, have been suddenly relieved by the discharge of hard plugs of ear-wax while engaged in bathing, the expulsion generally taking place with a loud report, like that of a small pistol. Such an occurrence can be explained only by supposing either that the steam of the hot water, penetrating the meatus, softens the indurated mass, or, what, is more plausible, that the bathing produces perspiration in the walls of the tube, thus detaching the substance, the noise being produced by the rarefaction of the atmosphere behind it.

#### d. POLYPOUS AND FUNGOUS GROWTHS.

Great confusion has hitherto prevailed among pathologists respecting the true distinction between polypous and fungous growths of the ear, these terms being generally applied indiscriminately to every form of tumor, whether developed within the tube or projecting from its outer orifice. I have long been in the habit of looking upon these

morbid products as being essentially different, and in my lectures I have always described them as being divisible into two classes, one of which is similar to the tumors which we so often observe in the nose and other mucous canals, while the other consists essentially of a mass of granulations, bearing only a faint and distant resemblance to genuine polyps.

Of polyps of the ear there are several varieties, of which the most common are the fibro-vascular, gelatinoid, and granular. Their structure is sufficiently indicated by their names. They are generally somewhat of a conical, pyriform, or globular shape, having a small, narrow pedicle, by which they are attached to the surface from which they grow, which is usually the posterior wall of the meatus, at the site of the ceruminous glands, or in their immediate vicinity. Occasionally, though rarely, they spring from the membrane of the tympanum itself, or very low down in the tube. Their surface is commonly smooth, and of a florid, pale, or pink hue, according to the character of their structure, or, rather, the extent of their vascularity. A polyp of the ear has sometimes the form, color, and consistence of a mulberry, or of a bunch of small grapes. Their number rarely exceeds one, unless they are very small, when there may be two. As they increase in size, they gradually approach the external orifice of the ear, and sometimes partially fill up the concha, forming a hard, cuticular mass, several shades lighter than the part which is buried in the tube, and also much less sensitive.

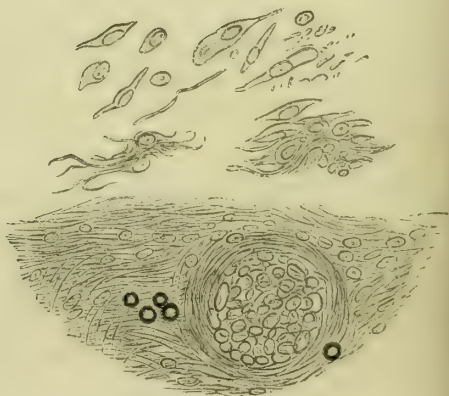
*Polyps* of the ear, of whatever structure, size, and shape, are attended with more or less discharge, which is either of a thin, sanious, or truly purulent character, and generally very fetid and acrid, often eroding the surrounding surface. The hearing is always impaired, and in many cases completely destroyed. The nature of the tumor is easily recognized by its history and appearance. Its point of attachment is generally ascertainable with the probe, which can always be insinuated between the growth and the auditory tube, no matter what may be its age.

The annexed sketch (fig. 246) represents a gelatinoid polyp, from a specimen in my cabinet. I removed it in 1856, from the right ear of

Fig. 246.

Fig. 247.

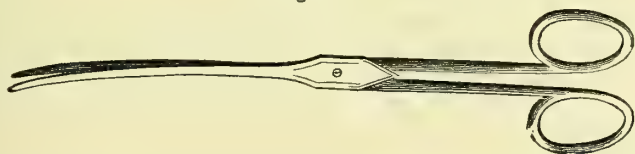
Fig. 248.



a man of twenty-six, where it had been growing for nearly three years. It was attached to the floor of the meatus, not quite as low down as its centre, by a narrow, slender pedicle, the base protruding slightly at the outer orifice. It was of a pale, whitish color, like an oyster, somewhat elastic, insensible, and smooth on the surface, with here and there a straggling vessel ramifying beneath its lining membrane. The drawing is of the natural size. Fig. 247, copied from Mr. Wilde, represents a singularly lobulated form of aural polyp. Fig. 248, from a drawing by Dr. Packard, represents the microscopical characters of a recurring fibroid polyp, which I removed from the ear of a young woman at the College Clinic last winter. It occupied the whole of the auditory tube, and had already been operated upon twice.

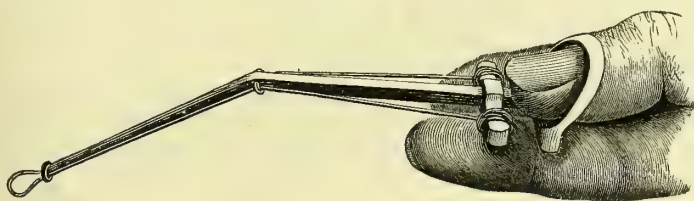
Polyps of the ear are best removed by avulsion with a pair of delicate forceps, either straight or curved (fig. 249), applied, if possible,

Fig. 249.



close to their pedicle, and rotated upon their axis. If a portion of the tumor is left behind, deep in the cavity, it may be scraped away with a curette, or cut off with a pair of cornea scissors. Instruments have been devised for ligating these growths; but, excepting the ingenuity expended upon their construction, they have little to recommend them. Fig. 250 represents the aural canula of Mr. Wilde. Caustics should

Fig. 250.



never be employed for removing them, it being difficult so to regulate their application as to prevent pain and other mischief. Where there is a strong repullulating tendency, recourse may be had to the cautious use of nitrate of silver, sulphate of copper, the dilute acid nitrate of mercury, or, what is better than all, chromic acid.

The second division of the subject embraces what are called *fungous growths* of the ear, a class of affections much more common than polyps. They consist, essentially, of a mass of granulations, of a soft, spongy consistence, and of a pale, florid color, which have their origin generally in an ulcerated condition of the auditory passage, the membrane of the tympanum, or the tube and drum together. Occasionally,



the immediate cause of their production is necrosis of the petrous portion of the temporal bone, or disease of the small bones of the ear. However induced, the growth often attains a large volume, filling up the meatus, and projecting sometimes a considerable distance into the concha. It is often quite sensitive, readily bleeds when rudely touched, and is always attended with a profuse, foul discharge.

As these growths are always of a secondary nature, it is evident that they cannot be permanently cured until the cause under the influence of which they are developed, has been effectually eradicated. The first object of the treatment, therefore, should be to get rid of the primary affection, whatever this may be. Meanwhile, however, any exuberant growth is removed either with the scissors, the knife, or the forceps, as may seem most convenient, repression being afterwards controlled by the cautious application of the ordinary escharotics. Cleanliness is an object of paramount importance in this form of the affection, and is best promoted by the frequent use of injections of tepid water, with castile soap and a small quantity of the chlorides.

Tumors of a *malignant* character sometimes grow from the auditory tube, commencing either in the soft structures, in the petrous portion of the temporal bone, or in the mastoid process. Whether certain forms of polyps or of fungoid excrescences, described in the preceding paragraphs, are capable of assuming this kind of action remains to be determined, but such a conclusion is certainly not unreasonable. However this may be, the malignant growth is, in general, easily recognized by the peculiarity of its color, which is always purple or livid, by the rapidity of its development, by its tendency to extend, not only outwardly, but laterally, in every direction, by its speedy reproduction after removal, by the almost insupportable fetor of the discharge, by the excessive pain, and, lastly, by the early involvement of the neighboring lymphatic ganglions. The constitution gradually becomes affected, and the patient at length sinks under all the symptoms of the cancerous cachexia, or he dies suddenly, and perhaps unexpectedly, from effusion upon the brain.

Such cases, which are fortunately rare, hold out no prospect of relief from any course of treatment of which we have any knowledge. All that can be done, therefore, is to palliate the symptoms, and smooth the sufferer's passage to the grave.

#### e. INFLAMMATION.

The auditory tube is liable to several forms of inflammation, either of a simple or specific character, which, although infrequent, are worthy of special notice on account of the severe suffering which they entail.

The most common variety of inflammation is the simple, which usually begins, so far as we are enabled to judge, in the skin and subcutaneous tissue of the tube, from which it often extends to the periosteum, and, perhaps, even to the superficial portion of the bone. I have, indeed, often thought that the disease bore a very striking resemblance, in some of its more prominent symptoms, to paronychia or whitlow. It is usually ushered in with a dull aching sensation,

which is soon converted into a violent throbbing pain, attended with a feeling of weight and obstruction, and various kinds of noises in the ear. The swelling is slow, but as it proceeds it often causes complete occlusion of the tube, and affects the parts around the ear, which are always exquisitely tender, and intolerant of the slightest pressure and motion. Hence, when the disease is fully established, the patient is unable to masticate his food, and to lie on the affected side. Headache and constitutional disturbance occasionally attend, and there is, in most cases, a strong tendency to suppuration, the matter being, however, always small in quantity, and deep-seated.

The origin of this disease is not understood. It is often witnessed in persons who are apparently in the most robust health; in some instances, however, it seems to depend upon a disordered state of the digestive organs, growing out of over-feeding, or the intemperate use of ardent spirits, and fostered by indolent habits. Occasionally, again, it occurs as a sequela of measles, scarlatina, typhoid fever, and smallpox. When the inflammation attacks a person already much debilitated by disease, it may prove dangerous by involvement of the brain and arachnoid membrane. When an abscess forms, the matter discharges itself either into the auditory tube, or it finds an outlet in the immediate vicinity of the ear, generally just in front of the temporo-maxillary articulation.

The *treatment* of this affection must be conducted upon general antiphlogistic principles. If the symptoms are violent, and the patient is robust, it may be necessary to take blood from the arm, to purge him actively, and to subject him to the use of the antimonial and saline mixture, with anodynes to allay pain and procure sleep. In general, however, these remedies may be dispensed with, our object being gained by the application of leeches to the anterior and posterior part of the ear, anodyne fomentations, light diet, and diaphoretics, especially if we resort to an early and free incision, which is often just as necessary here as in cases of whitlow, or of the ordinary phlegmonous boil. The opening should rather be deep than extensive, and it will sometimes be well, especially in the more severe cases, to make several punctures instead of a single one. When the disease is slow in disappearing, or when abscess after abscess forms, a course of alterative and tonic medicine will be indicated, along with a proper regulation of the diet, and change of air.

The disease now described occasionally assumes an *erysipelatous* type, or it may possess this type from the commencement. Its nature will be denoted by the peculiar discoloration of the skin, by the tendency of the disease to spread over the surrounding parts, and by the peculiar burning, itching, or stinging character of the pain. The treatment does not vary essentially from that necessary in the preceding case, only that the inflamed surface should be painted freely with the dilute tincture of iodine, and that, if matter form, the incision should be somewhat more extensive.

*f.* HERPETIC AFFECTIONS.

The auditory passage is occasionally the seat of herpetic disease, either as a primary affection, or as a propagation from the auricle, where it is by no means uncommon. It is characterized by the formation of numerous vesicles, generally more minute than the smallest pin-head, closely grouped together, if not confluent, and filled with a thin, whitish, or slightly yellowish fluid. The surface upon which the eruption rests is of a dusky reddish appearance, and the seat of intolerable itching. When the vesicles break, they are replaced by little ulcers, chaps, or fissures, discharging a thin, sanious fluid, which may be so copious as to run out upon the ear, and even upon the patient's pillow. The auditory tube is red, swollen, angry-looking, tender, and, at times, even quite painful from the great extent of disease. The suffering is increased by exposure, by the use of stimulating food, and by disorder of the alimentary canal. The affection may last for years, and finally extend to the membrane of the tympanum. Besides the itching, which is always a prominent symptom, the patient is troubled with noises in the ears, and with partial deafness.

In the *treatment* of this affection, particular attention must be paid to the state of the general health, which always exercises a remarkable influence upon its progress and duration. The secretions must be improved by a mild course of alteratives, the diet must be plain and non-stimulant, and the bowels must be moved from time to time with vegetable cathartics. If the patient be robust, the antimonial and saline mixture will be of service; and, when the disease proves obstinate, it may be necessary to have recourse to gentle ptyalism, and the use of iodide of potassium. The best local applications, at the commencement of the treatment, are leeches and the warm water-dressing, and afterwards, when the morbid action has been somewhat moderated, weak solutions of bichloride of mercury, acetate of lead, or iodide of iron, or, what I prefer to everything else, the dilute ointment of the oxide of zinc, in the proportion of one part to three of prepared lard.

*g.* INFLAMMATION OF THE CERUMINOUS GLANDS.

The glands which secrete the wax of the ear are liable to inflammation, either as a consequence of a suppression of the cutaneous perspiration, disorder of the digestive apparatus, the extension of some specific disease, or the presence of a foreign body. Its characteristic is an inordinate secretion of cerumen, accompanied with a sense of fulness and uneasiness deep in the auditory tube, which is at the same time perhaps considerably swollen, though rarely as much as in the more common forms of inflammation. The wax is of a pale-yellowish color, of a thin consistence, almost like water, and so abundant as to run out of the ear in considerable quantity. If it be allowed to remain, it closes up the passage, becoming thick and hard, of a dark-brownish, or blackish color, and firmly adherent to the walls of the tube. In ordinary cases there is little or no impairment of the hearing, but there is generally



more or less noise in the ear, especially when the disease extends to the membrane of the tympanum, in which case there may also be considerable deafness.

The *treatment* of this inflammation does not differ from that of the more ordinary forms. An active purgative, with light diet, and a few leeches behind the ear, generally suffice to put a speedy stop to the morbid action. If the disease has been the result of cold, benefit will arise from the use of diaphoretics, as Dover's powder, or a combination of antimony and morphia. To clear away the wax, tepid water, containing a little soap, should be gently injected into the ear, followed by some mildly astringent lotion, as a very weak solution of nitrate of silver, acetate of lead, or sulphate of copper and tannin.

#### *h.* HEMORRHAGE.

Hemorrhage of the ear is a rare occurrence. It may be the result of external injury, or of ulceration of a tolerably large vessel, and may have its seat either in the auditory tube, in the cavity of the tympanum, or in the parts immediately around the petrous portion of the temporal bone. Cases have occurred where the bleeding was so large and unmanageable as to lead to the belief that it proceeded from the internal carotid artery, laid open by an extension of the morbid action from the ear. The blood, in these cases, gushed out of the meatus in immense quantities, and, although it could temporarily be controlled, yet it ultimately caused death by exhaustion. When it proceeds from, or passes through, the cavity of the tympanum, it also escapes at the Eustachian tube, from which it is either ejected along the mouth, or, as is more common, it descends into the stomach. In fractures of the base of the skull, involving the meninges and the petrous portion of the temporal bone, there is often a copious discharge from the ear, at first of pure blood, and afterwards of sanguineous serum. Sometimes the bleeding is vicarious of the menstrual flux.

Aural hemorrhage is to be treated upon the same principles as hemorrhage in other parts of the body; by attention to position; the exhibition of opium and acetate of lead; cold applications to the mastoid process and the back of the head; and the use of the tampon. When the blood issues from the fauces, the Eustachian tube should be plugged with the catheter, its extremity being surrounded by a bit of sponge to secure more accurate closure.

### SECT. III.—DISEASES OF THE MEMBRANE OF THE TYMPANUM.

#### *a.* WOUNDS.

The membrane of the tympanum is liable to various kinds of wounds, either as the result of violence directly applied, or as concomitants of fractures of the skull. In the latter case, it is probably more frequently injured than the profession are aware. It is an interesting fact to know that, when the lesion is not too extensive, it is readily repaired by an

effusion of plastic matter, the process employed by nature being the same as in the healing of wounds in other parts of the body. Independently of clinical observation, which long ago established the fact, the experiments of Valsalva are perfectly conclusive upon the subject, proving that wounds of this membrane are susceptible of cicatrization, even when they are accompanied by a considerable loss of substance. This distinguished medical philosopher repeatedly perforated and even lacerated the membrane of the tympanum in dogs, which, after some time, he killed, when he found that the injury had been most thoroughly repaired in every instance. Similar experiments have been performed since the time of Valsalva by physiologists and surgeons, with precisely similar results. In the operation of excising a portion of the membrane for the cure of deafness, formerly so much in vogue, the great trouble has been to prevent the opening from closing. From all these facts, then, we may deduce the interesting conclusion that wounds of this membrane, even when attended with considerable loss of substance, are, in general, easily repaired. To promote this occurrence, in case of accident, the treatment should be strictly antiphlogistic, particular attention being paid to the position of the head, and free use being made of leeches behind the ear.

#### *b.* RUPTURE.

Rupture of the membrane of the tympanum may be produced in several ways, as a fall upon the side of the head, blowing of the nose, and the forcible introduction of a foreign body. The occurrence is generally attended with a loud noise, not unlike that caused by the discharge of a pistol, some hemorrhage, and a good deal of pain. As the edges of the rent retain their contact, the lesion is soon repaired by the interposition of lymph, without any permanent impairment of the hearing.

#### *c.* INFLAMMATION.

Inflammation of the membrane of the tympanum may arise from various causes, as exposure to cold, external injury, or the presence of a foreign body. It is a frequent sequela of measles, scarlatina, and smallpox, and is often directly dependent for its origin upon a strumous state of the system. Infants and young children are most prone to its attacks, especially such as are naturally of a delicate constitution, or who have suffered from poverty and want. When this is the case, it is often induced by the most trifling causes, and followed by the most disastrous consequences, such as partial destruction of the membrane, and partial or complete deafness.

Upon examining the inflamed membrane, with the aid of a strong light, it will be found to exhibit a pale rose color, which, as the morbid action advances, is generally converted into a deeper hue. Small, straggling vessels are seen ramifying over the affected surface, and the part, instead of being thin and transparent, as it is in the natural state, is thick and opaque, from interstitial deposits. The inflammation often

affects the adjoining parts, especially the bottom of the auditory tube, and when this is the case, there is also apt to be an increase of cerumen, soon followed by suppuration, or a discharge of muco-purulent matter.

Tympanitis is *characterized* by the existence of more or less pain, situated deep in the ear, and extending to the side of the head; it is generally described by the patient as exceedingly sharp, aching, and distressing, and is always aggravated by loud noise, stooping, coughing, or sneezing, and by exposure of the part to the cold air. As the disease approaches the suppurative point, the pain generally becomes throbbing, and almost agonizing, depriving the individual both of appetite and sleep. The parts around are now more or less tender, and the movements of the jaw add greatly to the local distress. The sense of hearing is usually considerably exalted; loud, cracking, or ringing sounds are perceived, and there is often a feeling of fluttering as if an insect were flying about in the ear. The inflammation, if at all severe, is attended with high symptomatic disorder, and occasionally with delirium.

In the *treatment* of acute tympanitis, active antiphlogistic measures are indicated, and they should be employed with the least possible delay, with the twofold object of saving structure, and preventing cerebral involvement, two great dangers in every severe attack of this kind. If the pulse be strong and full, the pain excessive, the mind delirious, and the skin hot and dry, blood must be taken freely from the arm, the operation being followed by the application of leeches over the mastoid process, a brisk purgative, the hot foot-bath, and the antimonial and saline mixture, with a sufficiency of morphine to relieve suffering and induce sleep. Copious diaphoresis should be aimed at, and promoted by tepid drinks. The steam of hot water, directed upon the ear and the adjacent parts by means of a funnel inverted over a large pitcher, will often prove exceedingly grateful, and afford more decided comfort than almost anything else. Its efficacy may be greatly enhanced by the addition of laudanum and powdered camphor, or camphor dissolved in alcohol. Covering the parts with a large emollient poultice, or hot cloths, will also be productive of great amelioration. The patient's head should be constantly maintained in an elevated position, noise should be excluded from the apartment, and the surrounding temperature should be regulated with the thermometer, especially in cold weather. If cerebral involvement be threatened leeching and counter-irritation will be necessary. In the event of there being any discharge, the syringe and tepid water may be had recourse to, but it is impossible to be too careful in their use, otherwise they will be sure to aggravate the disease instead of diminishing it. As to any direct application, the only one at all admissible, as a general rule, consists of equal parts of laudanum and sweet oil, slightly warmed, and introduced into the bottom of the ear, in immediate contact with the affected surface. Irritating lotions always prove prejudicial, and cannot be too much condemned.

Inflammation of the membrane of the tympanum probably terminates much more frequently in the formation of *abscess* than practitioners are



aware; but, owing to the difficulty of examining the parts when thus affected, the occurrence commonly escapes detection. The pus is seated in the submucous cellular tissue, and, although very small in quantity, generally leads to perforation of the membrane, and the discharge of the small bones of the ear; its formation being ordinarily preceded by rigors and delirium. The treatment is antiphlogistic. If the abscess is accessible, evacuation is effected by a cataract needle, and cicatrization promoted by the cautious application of nitrate of silver, upon the extremity of a probe.

Of *gangrene* of the membrane of the tympanum nothing is known. Such an event is doubtless possible, and probably occurs not unfrequently, especially in scrofulous subjects, as a consequence of eruptive disease. If this were not so, how could we explain the extensive destruction of this membrane which occasionally takes place within a few days after the establishment of inflammation, the occurrence of necrosis in the temporal bone, and the almost insupportably fetid discharges which attend certain diseases of the ear?

#### d. ULCERATION.

Ulceration of the membrane of the tympanum may be an effect of ordinary inflammation, both acute and chronic; or it may be caused by a strumous or syphilitic taint of the system; most generally the former. The erosive action may display itself in the form of little superficial abrasions, not larger, perhaps, than a small pin-head, and of a circular or oval shape; or in that of a deep and broad surface, with abrupt and well defined edges, rapidly followed by perforation of the affected part, and the discharge of some of the bones of the ear. The ulceration often proceeds until the whole membrane is destroyed, and all the adjacent parts, osseous as well as soft, are involved in the mischief. In such cases the morbid action sometimes extends to the substance of the temporal bone, and thence along to the brain and its meninges, leading to various effusions and the formation of abscesses, from which the patient seldom, if ever, recovers.

I am satisfied, from much experience and long observation, that most cases of ulceration of the membrane of the tympanum are of a strumous nature. The subjects are generally young, delicate children, who are either the offspring of persons who have perished from phthisis or from some allied disease, or who are themselves destined to become affected in that way. The exciting cause of the complaint is either exposure to cold or an attack of measles, scarlatina, or some other eruptive malady, whose tendency it is to impoverish the blood and exhaust the powers of the system. The ulceration is frequently of a very insidious character, coming on, without any pain, during the convalescent stage of the cutaneous disease, and continuing, with, perhaps, but little intermission, for an almost interminable period. We often meet with cases of this kind which have lasted for five, ten, and even fifteen years. The discharge is generally of a thick, cream-like consistence, of a yellowish color, verging upon greenish, and so horribly offensive as to render the patient disagreeable both to himself and to those around him.

Exposure to cold, derangement of the digestive organs, and neglect of cleanliness, always aggravate it. It is often attended with fungous, or polypous growths, and is liable, unless closely watched, to be followed by inflammation of the brain and its membranes. A sudden suppression of such a discharge, especially if accompanied by severe headache, should always be regarded with suspicion.

When ulceration, by whatever cause induced, is of long standing, or of considerable extent, deafness, more or less complete, is the inevitable consequence. All, therefore, that can be done in such a case, is to endeavor to arrest the disease, and happy is the surgeon who can succeed in his efforts; for it may truly be asserted that there is no affection which is more unmanageable, or more difficult to be brought under the influence of remedies. As to any improvement of the hearing, that is an occurrence hardly to be thought of. It is only when the disease is slight, and the constitution has not been impaired by previous suffering, that relief is to be looked for in this respect. The practitioner, indeed, cannot be too guarded in his prognosis. His rule of conduct should be to do all he can, but to promise nothing.

The *treatment* of ulceration of the membrane of the tympanum must, in general, be conducted empirically. When the disease has been induced by the presence of a foreign body, or the retention of pus in consequence of some morbid growth, the removal of the exciting cause will often of itself be sufficient to effect a cure; but where we have no positive information respecting this point, our course must, necessarily, be one of uncertainty. A careful examination should be made in every case, before we begin the treatment, of the condition of the parts, by washing out the ear with tepid water, thrown in gently with a large syringe. The prominent indications are, first, to allay fetor, and, secondly, to arrest the morbid action. The former is fulfilled by the cautious use of the chlorides, injected into the ear twice or thrice in the twenty-four hours; and the latter by counter-irritation, the topical application of nitrate silver, or various astringents, and by attention to the state of the system.

When the disease is of a strumous nature, or associated with debility, an alterant and tonic course will be indicated, consisting of iodide of iron and extract of cinchona, alternated with cod-liver oil, and aided by nutritious diet and exercise in the open air. The surface should be well protected, and sponged daily with tepid salt water, followed by dry friction. Too much attention cannot be paid to cleanliness, for, apart from the offensive character of the discharge, the accumulation of pus in the ear must necessarily tend to keep up the morbid action, and to increase the mischief. The nitrate of silver is undoubtedly among the best topical remedies we possess, but too much caution cannot be employed in its use. The strength of the injection should not exceed, at first, the eighth of a grain of the salt to the ounce of water, from which it may be increased to the fourth of a grain or even more, according to the tolerance of the affected surface. Another excellent article is the bichloride of mercury, used still weaker; it is particularly valuable in the scrofulous form of the disease, attended with an abundant discharge. Iodide of iron, sulphate of copper, acetate of

lead, and sulphate of zinc, are also proper remedies, under similar restrictions.

Whatever direct applications be employed, care must be taken not to let the discharge dry up too rapidly, lest disease should be excited in the brain and its membranes. This precaution is particularly necessary in cases of long standing, accompanied with extensive disorganization of the structures of the ear. To obviate this occurrence, and at the same time aid in arresting the ulcerative action, an issue should be established behind the ear, over the mastoid process, and kept open for a long time after all disease has apparently vanished. When symptoms of cerebral involvement arise, they must be promptly met by leeches, blisters, and such other means as will readily suggest themselves in a case of such emergency.

Should the disease be of syphilitic origin, it will be necessary, in addition to the local means here pointed out, to place the patient upon the use of iodide of potassium, either alone or in conjunction with bichloride of mercury, in small doses, continued sufficiently long to produce slight pyalism.

To the disease now described, the term *otorrhœa* is usually applied by aural surgeons; and practitioners, in prescribing for it, unfortunately too often forget that the discharge which accompanies it is merely a symptom of the affection, and not the disease itself. Another mistake which is often committed is the belief that the malady upon which the discharge depends will in time disappear spontaneously, or, to use a vulgar phrase, that the patient, especially if a child, will gradually outgrow it. Such an opinion is as absurd as it is culpable, and cannot be too severely censured. The poor patient, confiding in the judgment of his professional adviser, goes on from bad to worse, until, awakening from his dream, he finds that his ear is completely disorganized, and that he is irremediably deaf. Such cases are of constant occurrence in every community; and, while they are calculated to awaken our sympathy for the sufferer, they cannot fail to excite our indignation at the practitioner, who, either through ignorance or indolence, or both, neglects to make himself acquainted with the nature and treatment of the disease.

#### SECT. IV.—INFLAMMATION OF THE CAVITY OF THE TYMPANUM.

This disease, which has been variously designated by aural surgeons, the terms being nearly all more or less objectionable, is seated in the lining membrane of the middle ear, which is continuous, along the Eustachian tube, with that of the fauces. As it progresses it may invade other structures, such as the fibrous layer of the tympanum, and even the labyrinth; or, beginning in these, it may extend to and involve the mucous tissue secondarily. Unfortunately, our knowledge of the maladies of these delicate parts of the organ of hearing is too limited to enable us to speak very positively upon the subject; their deep situation, the difficulty of exposing them, and the infrequency of their fatality, being so many reasons of the imperfection of our



information. Inflammation here is probably more common than is generally imagined, and it is not at all unlikely that some of the fatal cases of disease of the base of the brain, which we meet with, from time to time, have their seat originally in the middle and internal ear.

Of the *causes* which produce this disease, it is not always, if indeed generally, possible to form a correct idea, as they are usually more than commonly obscure. The patient, if he is old enough to give an account of himself, often ascribes it to the effects of cold, in consequence, perhaps, of exposure to a shower, sitting in a draught, or bathing in cold water. He is conscious, at any rate, that he was seized soon after with pain in the ear, and he is disposed, consequently, to refer his suffering to that particular cause. There is no question at all that this kind of exposure is the most frequent exciting cause of internal otitis. It may also be induced, however, by external injury, by the presence of a foreign body, by irritating applications to the membrane of the tympanum, and by an extension of inflammation from the tonsils and fauces along the Eustachian tube. Children and young persons are its most common subjects, such especially as are of a strumous predisposition. Occasionally the disease is caused by a syphilitic state of the system; when this is the case, it is generally associated with similar disorder in other parts of the body, as the throat, nose, and bones.

The affection is ushered in by pain in the ear, which is speedily followed by fever, alternating with rigors. The pain is deep-seated, and, rapidly increasing, soon amounts to intense agony, being of a tearing, boring, dragging, or pulsatile character; it is aggravated by the slightest motion of the head, and darts about in different directions, as the temple, forehead, mastoid process, and teeth, which often ache most violently. Cephalalgia is generally present from the beginning, and is soon succeeded by delirium; the patient is unable to rest for a moment in the same position, and is harassed with all kinds of noises, while the sense of hearing is in the highest possible state of exaltation; the countenance is flushed, the eyes are suffused, and there is a wildness of expression indicative of the most intense suffering. In the worst forms of the affection, the pain extends along the Eustachian tube into the throat; the whole side of the head becomes exquisitely tender; the fever increases in intensity; coma at length sets in; and the patient expires under all the symptoms of disease of the brain and its membranes. Upon dissection, matter is found in the cavity of the tympanum, and also, not unfrequently, over the petrous portion of the temporal bone, with effusion of serum into the arachnoid sac. In protracted cases, the temporal bone is carious or partially necrosed, and separated from the dura mater by a distinct abscess. When the patient survives, the matter is sometimes suddenly discharged through the external ear, followed by partial relief of the frightful suffering previously endured. The mitigation thus produced, however, is often only temporary, death being caused afterwards either by exhaustion, or, as more generally happens, by inflammation of the brain and its envelops. The period at which this event happens varies from eight or ten days to several months. In the latter case,

the patient is assailed by hectic irritation; he becomes feeble and emaciated; his countenance exhibits a sallow, cadaverous appearance; there is a profuse discharge from the ear, or from the ear and the Eustachian tube; and the mind is feeble, incoherent, or fatuous.

In regard to the *diagnosis* of this disease there is hardly a symptom which is at all worthy of reliance. Perhaps the most important is the violence of the pain, its depth, its unremittingness, and its association with fever, rigors, and delirium. If the patient be a child, the head will be in constant motion, and the hand incessantly carried to the ear; an adult will express himself as being in great torture. The general excitement is higher than in external otitis, the ear is more intolerant of sound, and there is always marked delirium, usually beginning early, and lasting until the malady disappears or proves fatal. Another point of distinction of some value is that matter forms much later than in inflammation of the membrane of the tympanum, or of this structure and of the auditory tube, in which suppuration generally takes place in from twenty-four to forty-eight hours. Finally, there is more tenderness in the mastoid and temporal regions than in external otitis, and more pain in moving the head, sneezing, coughing, and mastication.

The *treatment* of internal otitis must be of the most prompt and vigorous character. No time must be lost in half measures, or in doubt and indecision; it must be recollected that the disease is one of great danger, not merely as it respects the parts more immediately involved in the morbid action, but also the patient's life. Without entering at all into details, which are unnecessary, it may be stated that the great remedies in every case of the kind are general and topical bleeding, active purgation, the free use of the antimonial and saline mixture, the hot foot-bath, and the exhibition of anodynes, in doses sufficient to allay pain and promote sleep. The best direct application is the steam of warm water, containing a considerable quantity of black drop and powdered camphor, and conducted into the ear by means of an inverted funnel. The head should, at the same time, be well covered with cloths wrung out of hot water, noise should be excluded from the apartment, and the body should be steadily maintained in the semi-erect posture. One great aim of the treatment should be to bring about early and copious diaphoresis, experience having shown that it exerts a wonderfully controlling influence over the morbid action. As soon as proper depletion has been practised, counter-irritation should be established over the mastoid process, and, where the brain is likely to be involved, also in the nape of the neck, at first by means of blisters, and afterwards by issue, seton, or tartar-emetic ointment. When structural lesion is dreaded, mercury should be given in full doses, with a view to its speedy constitutional effects. Should matter form in the middle ear, as denoted by the convex and opaque appearance of the membrane of the tympanum, a puncture should be made to serve as an outlet to the pent-up fluid, its escape along the Eustachian tube being generally prevented by adhesive inflammation.

When the disease assumes a chronic form, our chief reliance is upon tonics, light, but nutritious diet, and pyogenic counter-irritation, with

the internal use of minute doses of mercury, with a view to slight but persistent ptyalism. The patient must be carefully watched, and precaution taken to protect the brain and prevent relapse.

#### SECT. V.—DISEASES OF THE INTERNAL EAR.

##### *α.* NERVOUS DEAFNESS.

There is a species of deafness to which, for the want of a better expression, the term nervous is applied. The symptoms which characterize it have long been well understood, but as it respects its pathology we are still, in great degree, in conjecture. It resembles, in many of its essential features, amaurosis. It was, for a long time, attributed to paralysis of the auditory nerve, as amaurosis was attributed to paralysis of the optic nerve. That such an occurrence is possible is undeniable, but that much more importance has been ascribed to it than it is entitled to, is equally true. Indeed, there is reason to believe that, in the great majority of cases of what is called nervous deafness, the disease, instead of being caused by a want of power in the nerve of hearing, as a primary lesion, depends wholly upon inflammation. This has certainly been ascertained to be the fact in regard to amaurosis, and that the same circumstance obtains, in relation to nervous deafness, is now, I believe, generally admitted. Too much stress cannot be laid upon this view, when we consider the influence which it must exert upon the treatment of this class of affections. Under the supposition that it was, from first to last, a purely nervous disease, the most erroneous practice was pursued, and this is, perhaps, one reason, among many others, why aural maladies have been so long a specialty in the hands of the empirics.

Of the exciting *causes* of this form of deafness, our information is not very reliable. In many of the cases that I have been consulted about, the disease appeared spontaneously, without the patient being able to assign any reason whatever for its occurrence. Occasionally I have known it to come on soon after an attack of typhoid fever, attended with an unusually tardy convalescence. Measles and scarlet fever are also sometimes followed by it. Several of the worst cases of nervous deafness that I have ever seen, occurred, apparently, in consequence of bathing in cold water, after the body had been overheated by exercise. Profuse and long-continued diarrhœa, protracted hemorrhages, the inordinate use of purgatives, masturbation, and abuse of sexual intercourse, have often been known to induce the affection. Another cause, and one which, according to my experience, is more than commonly operative, is chronic dyspepsia, so rife among the people of this country.

The disease generally begins in one ear, and after continuing for some time, attacks the other; or it may be confined to one ear exclusively; or, lastly, it may commence simultaneously on both sides, and proceed uniformly or otherwise, until audition is completely lost. Sometimes the disease is produced almost instantly. I saw, not long ago, a child,



four years old, who went to bed perfectly well in the evening, but woke up completely deaf in the morning. Sudden fright and the concussion occasioned by the firing of a cannon or even a pistol, have been known to deprive persons instantly of the faculty of hearing.

Nervous deafness is sometimes hereditary. I give the following case, which came under my observation some years ago, as an illustration of this fact:—A young man, Samuel Hirsh, a German, aged twenty-one, of Memphis, Tennessee, is partially deaf in his right ear, evidently from an affection of the auditory nerve; the disease has been coming on gradually for the last eighteen months, and is steadily increasing; it is attended with great buzzing, as well as other disagreeable noises, and with occasional headache. He has never had typhoid fever, measles, scarlatina, or smallpox. He is one of nine children. His oldest brother is thirty-five years of age, and is very deaf in both ears; a sister, aged thirty, is quite deaf in one ear. The father is deaf in both ears, and so is a paternal aunt. The maternal grandfather is likewise deaf. The mother hears well.

The first intimation which the patient usually has of his infirmity is, perhaps, derived from his friends, who, in their intercourse with him, are rendered conscious that he does not hear so well as formerly. They are obliged, in addressing him, to repeat their questions or answers more frequently than formerly, and to speak in a louder tone and more emphatic manner. Simultaneously with this occurrence there are various noises in the ears, at first slight and occasional, but becoming gradually more and more intense and steady, until, in time, they constitute the great and absorbing symptom. In regard to the character of these sounds nothing could be more strange and diversified. Thus, in one case they resemble the ticking of a watch; in another, the ringing of a bell; in a third, the buzzing of an insect; in a fourth, the chirping of a bird. In some instances they are like the rustling of the wind among leaves, the pattering of rain, the roaring of a water-fall, the motion of a saw-mill, the boiling of a tea-kettle, or the whistling of a steam-engine. These noises are generally confined to the ears, but cases occur, and they are not infrequent, in which they extend over the whole head, causing the most disagreeable and distressing feeling. Fatigue, loss of sleep, exposure to cold, damp states of the atmosphere, and the depressing passions, have the effect of increasing them, and of aggravating the patient's suffering, often producing fits of the most dreadful despondency. On the other hand, it is not unusual for slight improvement to occur, although it is generally very transient, lasting, perhaps, not more than a few hours, or, at most, only a few days. During this time the hearing is not only improved, but there is a considerable diminution of sound, and illusive hopes are entertained of speedy recovery. Presently, however, the symptoms recur in all their former intensity, and the disease goes on rapidly from bad to worse until the deafness is complete.

There are cases of this affection in which there is an entire absence of noise. They generally come on very suddenly, in consequence, often, of some affection of the brain, and are of the most hopeless cha-

racter, as it respects recovery. It is probable that this variety of the disease is due to paralysis of the auditory nerve.

Nervous deafness is seldom attended with any pain in the ear or the surrounding parts. The patient, in addition to the noises already described, often complains of a sense of fulness in the organ, or a feeling as if the auditory tube had been stopped up with water; but as to actual pain, he does not experience any, except occasionally, as an intercurrent and adventitious circumstance. The general health is variable. In many cases it is impaired, perhaps very materially, at the moment of the attack; but in some it is apparently as perfect and vigorous as it ever was. Some of the very worst examples of nervous deafness that I have ever witnessed occurred in persons of this description. The period which intervenes between the commencement of the first symptoms and the occurrence of complete deafness varies from a few weeks to a number of years. Occasionally the individual is able to hear more or less all his life, especially if he use an ear-trumpet.

The ear, in nervous deafness, often retains its normal appearance most perfectly. The secretion of cerumen proceeds as before, and there is not the slightest evidence of disease in the membrane of the tympanum. Cases, however, occur in which there is a total absence of wax, and in which the drum is not only unusually dry, but more or less opaque. When touched with a probe, it is often found to be remarkably sensitive, as is the case also frequently with the parts immediately around.

Among the thousand and one remedies that have been recommended, from time to time, for the relief of nervous deafness, there is not one which is worthy of the slightest reliance in a curative point of view. In my own practice, I have so rarely derived any benefit from the various means that have suggested themselves to my mind, in the treatment of this affection, that I have, of late, been induced to look upon it as being generally altogether beyond the reach of our skill; and in this sentiment most surgeons will, I am sure, fully coincide. Whatever benefit results is usually of a transient character, and is due, in great measure, if not wholly, to the effects which our remedies exert upon the condition of the general health, rather than to any improvement in the ear itself. The misfortune is that, in most cases, the affection is entirely neglected in its earlier stages, at a time when treatment might, perhaps, be of service. The patient, thinking that it is a matter of little moment, and that it will gradually vanish of its own accord, feels little inclined to apply for advice, and hence the consequence is that, when his fears become excited, it is generally too late to do him any good. When the disease supervenes suddenly, and in its more decided forms, I believe that no remedies, however judiciously employed, will be of any avail. All experience goes to show that such cases are generally hopeless. Under opposite circumstances, however, I always deem it my duty to institute as rational a course of proceeding as our limited powers of observation will admit. Looking upon the disease as being generally of an inflammatory origin, and, therefore, as likely to produce structural disorder, I believe that the best plan that can be adopted is to put the patient upon a very mild

course of mercury, giving from a fourth to half a grain of calomel three times a day, until there is slight soreness of the gums, which should be diligently maintained for a number of weeks, care being taken to avoid everything like salivation. If plethora exist, recourse may be had to active purgation, leeching behind the ears, and even general bleeding, along with light diet, and a seton in the neck, or, what I deem more judicious, a small issue over each mastoid process. If, on the other hand, there is evidence of general debility, as happens in a plurality of such cases, the mercury must be combined with tonics, as iron and quinine, a nutritious diet, the shower-bath, and daily exercise in the open air, with saline ablutions and dry frictions. I place great confidence in the use of mercury in this disease, particularly in its earlier stages, from its salutary effects in preventing structural change. When the lesion is fully established, I have never experienced any benefit from it, and have, therefore, of late, ceased to prescribe it under such circumstances.

In regard to direct applications, it is impossible to observe too much precaution. When there is opacity of the membrane of the tympanum, the affected surface may be gently touched, once a day, with a little dilute mercurial ointment, or a solution of nitrate of silver, in the proportion of half a grain of the salt to the ounce of water. Another appropriate remedy is glycerine with a small quantity of spirits of camphor. Whatever substance be employed, care must be taken that it acts as a sorbefacient and not as an irritant; otherwise serious mischief may ensue.

The treatment of nervous deafness by the introduction of the vapor of nitrous ether into the cavity of the tympanum, through the Eustachian tube is, I believe, no longer employed by any sensible practitioner, notwithstanding the high encomiums that have been lavished upon it by Kramer and other professed aurists. From personal experience with the remedy I was led, long ago, to regard it as one of the delusions of surgical practice; a conclusion which has been fully verified by the later observations of others. Of electricity and electro-galvanism, as means for relieving nervous deafness, I have not made sufficient trial to enable me to speak with certainty; but, judging from the reports of others, I should be inclined to place no reliance upon them.

#### *b.* DEAFNESS FROM DISEASE OF THE TYMPANUM AND OTHER CAUSES.

Besides the form of deafness now described there are others, some of which are transient and curable, others permanent and irremediable. In order to appreciate their character, it will be necessary briefly to inquire into their causes. These will be found to be both numerous and diversified.

1. Deafness is often produced by *destruction* of the membrane of the tympanum, either as an effect of ulceration, of a wound, or of the contact of some acid, introduced by design or from mischief. When the lesion is considerable, it is necessarily accompanied by the loss of the small bones, and by the annihilation of the sense of hearing. In-



injuries of the skull and brain are occasionally followed by deafness, sometimes partial, at other times complete. This effect is most liable to supervene upon injuries involving the base of the cranium, especially such as are attended with fracture of the petrous portion of the temporal bone and laceration of the meninges of the brain; but it may also take place when the lesion is seated upon the side and top of the skull, and is apparently of a more trivial character. A severe box upon the ear or temple has been known to cause permanent deafness.

2. Mere *concussion* of the membrane of the tympanum sometimes occasions deafness. I have seen several cases where it was caused by the discharge of a cannon, a gun, and even a pistol. Artillery men are occasionally, in an instant, deprived of the faculty of hearing during the progress of a battle, or the firing of a salute, in consequence of the sudden and violent agitation of the air. Under such circumstances, indeed, it is not uncommon to notice a considerable flow of blood from the ear.

3. *Caries* and necrosis of the temporal bone are a frequent cause of deafness. The same effect may be induced by the pressure of a tumor upon the nerve of the ear, the long retention of hardened wax, the pressure of a foreign body upon the membrane of the tympanum, the deposit of lymph, or tubercular matter in the middle cavity of the ear, and occlusion of the Eustachian tube.

4. Violent sneezing and *coughing* have been known to produce deafness. Of the truth of this fact there can be no question, as several well authenticated cases of it are upon record.

5. Another cause of deafness is frequent washing of the head in cold water, cutting of the hair very close in cold weather, or exposing the head, especially when the body is overheated, to currents of cold air.

6. The inordinate use of *quinine* has occasionally caused complete and irremediable deafness in a few hours. Of this occurrence numerous cases are to be found among the inhabitants of our Southern States, where this article is often given in enormous doses.

7. Deafness is sometimes produced by *worms* in the alimentary canal, the repulsion of cutaneous disease, and the suppression of habitual discharges. Lauzani mentions the case of a woman who suffered from deafness during four successive pregnancies.

8. Loss of hearing may be occasioned by effusions upon the base of the *brain*, whether the result of traumatic causes, tuberculosis, or common inflammation.

9. Deafness is sometimes dependent upon *malformation* or disease of the internal ear. Cases occur in which there is no trace whatever of the vestibule, cochlea, and semi-circular canals. Occasionally the labyrinth is composed of a single cavity, shut off entirely from the tympanum, as in the crustaceous animals. Finally, the internal ear is sometimes occupied by scrofulous matter, serum, fibrin, or a substance resembling chalk.

10. The cause of deafness may reside in the cavity of the *tympanum*, which may be filled up with various kinds of materials, as mucus, lymph, pus, and blood, interfering with the transmission of sound.

A substance resembling tubercle, and consisting of granules, epithelium, and oil globules, has been found in this portion of the ear, the occurrence being most common in young subjects of a scrofulous predisposition. Finally, the cavity of the tympanum may be absent; and there are cases in which there is imperfect development of the small bones of the ear.

11. There may be lesion of the *auditory nerve*; consisting either in imperfect development, interstitial deposits, induration, softening, paralysis, or compression by osseous and other matter.

12. Deafness may be occasioned by lesion of the *mastoid process*, the cells of which are lined by a reflection of the mucous membrane of the middle ear, and which are, therefore, liable to the same kind of diseases. Inflammation, whether traumatic or idiopathic, may lead to various changes in this supplemental portion of the ear, all more or less prejudicial to audition. It is also liable to malformations, obliteration, and scrofulous deposits.

13. Finally, deafness, partial or complete, may be caused by enlargement of the tonsils, by polypous tumors of the nose, and by various affections of the fauces.

It is not necessary to enter into any formal disquisition respecting the *treatment* of these various kinds of deafness. Their chief interest consists in their diversity, and the consequent necessity of inquiry into their character before we attempt their removal by the use of remedies. Some of them, from their very nature, are incurable; others, for the same reason, hold out a prospect of relief by judicious treatment; and not a few will disappear spontaneously, or simply by the operation of time.

When the deafness depends upon the loss of the drum of the ear, the hearing may often be greatly improved by an artificial substitute, consisting of a circular or oval piece of very thin India-rubber, as originally suggested by Mr. Toynbee, of London. It is attached to a very delicate wire rod, a little more than an inch in length, and can be very easily introduced and withdrawn by the patient himself. When no such contrivance is at hand, great comfort and advantage will be derived from the use of a little pellet of cotton-wool, moistened with glycerine, and inserted into the ear, in contact with the aperture at its bottom. Substitution may be effected once or twice a day, according to the amount of discharge.

#### SECT. VI.—DISEASES OF THE EUSTACHIAN TUBE.

The Eustachian tube, which establishes a direct communication between the middle ear and the fauces, is liable to various affections, which influence, to a greater or less extent, the function of audition. These affections may be thus enumerated: 1. Congenital occlusion. 2. Inflammation. 3. Mechanical obstruction. 4. Stricture.

1. Congenital *occlusion* of the Eustachian tube is probably more frequent than the profession are aware. It is similar to the malformation which is met with in some of the other mucous outlets of the

body, as the anus, urethra, and vagina, and may affect the entire canal, or be limited to a particular portion. In the latter case, the obstruction is caused either by a small membrane, not unlike a hymen, or by the presence of fibrous, fibro-cartilaginous, or cartilaginous tissue. However induced, it is generally, if not always, a cause of deaf-dumbness, and is beyond the reach of treatment.

2. The Eustachian tube being lined by a reflection of the mucous membrane of the fauces, is liable to *inflammation* and its various consequences, as thickening, ulceration, and even gangrene. Scrofulous children, affected with chronic disease of the tonsils, are particularly prone to suffer in this way. The inflammation of the fauces often continues for years, being constantly subject to exacerbations from the slightest exposure to cold, derangement of the digestive organs, and whatever has a tendency to excite and maintain general debility. Being kept in a state of habitual congestion, the membrane becomes gradually indurated and thickened from interstitial deposits, and thus ultimately encroaches very seriously upon the caliber of the tube. Similar effects are often produced in inflammation of the throat consequent upon some of the eruptive diseases, particularly measles, scarlatina, and smallpox. The morbid action thus awakened not unfrequently extends into the Eustachian tube, and thence along the tympanum, where, leading to various deposits and alterations of structure, it may be followed by the worst effects.

*Ulceration* of the Eustachian tube is observed chiefly in connection with constitutional syphilis, attended with destruction of the tonsils and the arches of the palate. Under such circumstances, the membranous portion of the canal may be entirely eroded, followed, during the healing process, by occlusion of the remainder of the passage. Gangrene of the tube is extremely rare.

Inflammation of the Eustachian tube may lead to a deposit of *plastic* matter. Such an event, however, must necessarily be uncommon, but its occurrence has been demonstrated by dissection, and, therefore, admits of no dispute. When the quantity is considerable, it may cause permanent closure of the tube. Of suppuration of this passage very little is known, but the probability is that it is much more common than is usually imagined.

3. Mechanical obstruction of the tube may be caused by the presence of inspissated mucus, fibrin, blood, and earthy matter.

Inordinate secretion of *mucus* is an occasional occurrence in this tube, chiefly, we may suppose, as a consequence of chronic inflammation. When the fluid is very thick, or long retained, it may completely clog up the passage, and thus seriously impair hearing. The occurrence will be more likely to happen when the mucus is intermixed with plastic matter. Fibrin alone may be a cause of obstruction, and so also may be a clot of blood, the result of hemorrhage in the internal ear.

Finally, a substance resembling *chalk*—probably nothing but altered tubercular matter—is sometimes found in the Eustachian tube, closing it either partially or completely, and thus acting as a cause of deafness.

4. *Stricture* of the Eustachian tube is uncommon. It presents itself



in various forms and degrees, but has hardly been studied with sufficient care and attention to enable us to give any satisfactory account of it. It generally appears as a small, narrow band, stretched across the tube from one side to the other; or, as a ring-like contraction; or, as when it involves the osseous part of the canal, as a species of exostosis, growing inwardly, and filling up the conduit. Sometimes the passage is obliterated nearly from one extremity to the other. However constituted, the obstruction is usually permanent, although it may not be, complete.

The various affections of the Eustachian tube above described can be diagnosed only by means of the catheter, all other attempts at arriving at a knowledge of them being vain and nugatory. It was formerly imagined that the existence of obstruction, from whatever cause arising, could be determined simply by inflation, by shutting the mouth and holding the nose; it being asserted that if the air did not penetrate the tube, it was an evidence that it was closed. Nothing, however, can be more erroneous; for there are, as is well known, many persons who cannot by any effort they can employ, inflate this passage at all, however clear it may be. I have myself never been able to blow air into my left Eustachian tube, although my hearing has always been perfect, and the operation always promptly succeeds on the right side. Catheterism, then, is the only reliable means of diagnosis, and it is so much the more valuable, because, while it enables us to obtain important information respecting the nature of the disease, it is one of the best methods of cure.

*Catheterism* of the Eustachian tube is quite as simple an operation as that of the bladder; but as it requires for its successful execution, an unusual amount of practice, as well as a most accurate knowledge of the anatomy of the parts, it is evident that it can never come into general use. Besides, it is an operation which requires great delicacy on account of the exquisite sensibility of the Eustachian tube, as well as of the surface immediately around. For want of proper care in its performance, serious mischief has been produced.

Different kinds of instruments are in vogue for exploring this canal; some being straight, others curved; some flexible, others inflexible. The one which I have always been in the habit of using, and which will be found to answer the purpose most admirably, is represented in the adjoining cut (fig. 251). It is composed of silver, and is conse-

Fig. 251.



quently inflexible; being six inches in length, and having a short curve at its distal extremity, with a very smooth probe-pointed orifice. It varies in diameter from the size of a crow quill to that of a small goose quill, according to the age of the patient. In its general outline it is somewhat conical; and the ring at its large extremity corresponds with the concavity of the curve at the smaller one; an arrangement

which is found useful in the introduction of the instrument, as it indicates the direction of its point.

The patient being seated upon a chair with the head thrown backwards against the breast of an assistant, the catheter, properly oiled and warmed, is inserted into the nose, its concavity being directed downwards towards the floor of the nostril, along which it is conveyed until it reaches the fauces. Its point is now turned upwards and outwards, so that the ring of the instrument shall be in an oblique position, while its body shall lie in close contact with the outer wall of the nasal fossa. All that is required now is to pass the catheter gently on, when it cannot fail to reach the tube, its entrance being denoted by a want of resistance, and a feeling as if it moved in a narrow track. The distance to which it may be carried, will depend upon its size and upon the presence or absence of mechanical obstruction. Under no circumstances, unless the instrument is uncommonly small, can it be pushed on into the middle ear.

If now, while the catheter is in this position, air be blown through it into the tube, we shall be able to determine, at least in many cases, both the degree and the character of the obstruction. Thus, if the closure be partial, the fluid will readily find its way into the middle ear, very much as when we attempt inflation by shutting the mouth and nose; whereas if it be complete no such effect will follow. The presence of mucus can generally be detected by the peculiar gurgling or rustling sound which the patient perceives as the air rushes past the accumulated fluid; and soon after he will probably be conscious of a diminution of the disagreeable noises which previously disturbed him. If, on the other hand, the obstacle is of a solid nature, the sound produced by the inflation will be indistinct, or similar to that caused by blowing against a bone or other hard body.

Stricture of the tube, from ordinary inflammation, may be suspected when the point of the instrument, after having passed a certain distance, refuses to advance any farther. We may suppose that the obstruction is osseous, calcareous, or gristly, when the resistance is uncommonly great, and the contact of the catheter elicits a sharp noise. The existence of mere deafness, or of various sounds, cannot, considered by itself, be regarded as an evidence of closure of the Eustachian tube, as it is a concomitant of different affections.

Catheterism of the Eustachian tube is an important means of treatment in affections, not only of the canal itself, but of the middle ear, whether arising from mere thickening of the investing membrane, or accumulation of mucus. In the former case, the mere contact of the instrument often produces an excellent sorbefacient effect, at the same time that it aids powerfully in the removal of the morbid sensibility of the tube, which is so generally present in inflammation. The operation may be repeated, at first, once every fourth day, and afterwards every twenty-four hours, the instrument being retained several minutes each time. It may be assisted by the inflation of air from the operator's mouth, or, after the withdrawal of the catheter, by the patient's own efforts.

When more direct medication is required, the object may be attained

by the injection of tepid water, slightly impregnated with some astringent article, as sulphate of zinc, acetate of lead, or sulphate of alum. Great care must be taken that the solution is as mild as possible, otherwise much harm may result. A better remedy than any of these is the nitrate of silver, in the proportion of about an eighth of a grain to the ounce of water. Whatever substance be used, great caution must be observed in regard to the repetition of the injection, which should not, on an average, be oftener than once every third or fourth day.

Along with these means, special attention should be paid to the general health; the diet should be properly regulated; the bowels should be maintained in a soluble condition; and an issue should be kept up behind the ear. When the disease is obstinate, and fairly attributable to the effects of inflammation, benefit will be derived from slight and steadily continued ptyalism.

Deafness caused by permanent occlusion of the Eustachian tube has been treated, in modern times, by perforation of the membrane of the tympanum. The operation was proposed early in the present century by Sir Astley Cooper, and was at one period much in vogue among surgeons, although it is now obsolete. The object was to drill a small opening into the membrane of the tympanum, in order to admit air into the middle ear, the absence from which, as was alleged, was the principal cause of the want of hearing. It having been found that the aperture thus made had a tendency in a short time to close, thereby frustrating the intention of the operation, an instrument was devised for cutting out a circular piece of the membrane. Professor Smith, of Baltimore, thought he had effected a great improvement when he invented his perforator, and for a while the most sanguine hopes were entertained that deafness would henceforth be a more amenable affection. These expectations, however, have not been realized, and so little confidence is now reposed in the operation that we never hear of its being executed by any one. Soon after I entered the profession, I had occasion to give it a trial in two instances, which I considered to be quite favorable to the undertaking; but, although I succeeded perfectly in each case in excising a sufficiently large piece of the tympanum, yet not the slightest benefit followed. Of late years I have not thought proper to repeat the operation, for the reason chiefly that, while it is painful and not altogether devoid of danger, it is hardly possible to find a well authenticated case in which it has proved beneficial. Whether the procedure will ever be revived is very questionable; certainly not with our present views of the pathology and treatment of aural diseases.

#### SECT. VII.—OTALGIA.

Pain in the ear, or ear-ache, is of very frequent occurrence, especially in children and young persons, and may arise from a great variety of causes, as exposure to cold, inflammation of the membrane of the tympanum or auditory tube, gout and rheumatism, disorder of the digestive organs, and affections of the teeth. Sometimes it is



of a purely nervous or neuralgic character, coming and going in regular paroxysms, like neuralgic pain in other parts of the body. Children, especially such as are of a delicate constitution, are very obnoxious to severe attacks of ear-ache from exposure to cold. The suffering usually comes on in the evening, and is generally aggravated by recumbency, so that the patient is obliged to get up and walk the room, or has to be supported, if he be a child, in his nurse's arms. Ear-ache, often of a very distressing character, is a common attendant upon measles and scarlatina; and under such circumstances, as well as in many others, the probability is that it is merely a symptom of ordinary inflammation of some of the structures of the ear. What corroborates this view is the fact that the membrane of the tympanum and auditory tube usually afford evidence of the morbid action, the former being red and injected, and the latter exquisitely tender and the seat of an inordinate secretion of cerumen.

Neuralgia of the ear is most common in children, although it may occur at any period of life, and under circumstances apparently the most opposite. Its causes are various, being sometimes purely local, at other times constitutional, while in a third series of cases they are of a mixed character. During my residence in Kentucky, where neuralgia, in all its forms, is so exceedingly common, I met with several cases of this affection, which were unquestionably of a miasmatic origin. The paroxysms observed the same regularity as those of intermittent fever, recurring once in the twenty-four hours, or once every other day, lasting for some time, and then gradually disappearing; being generally preceded by chilly sensations, or even by a severe rigor, followed by a pretty copious sweat, and promptly relieved by the ordinary anti-periodic remedies.

In the *treatment* of otalgia it is a matter of primary importance to obtain, if possible, a clear idea of the nature of the exciting cause, as upon a knowledge of this must depend the choice of our remedies. If the teeth are at fault they must be extracted, or, at all events, put in order, before we can reasonably hope for a subsidence of the local distress; and the practitioner who does not inquire into the condition of these organs, in these cases, is guilty of a most important dereliction. The removal of a carious tooth is often followed by instant relief and a permanent cure. When the attack has been caused by exposure to cold, the most efficient treatment consists in a hot foot-bath and a full dose of Dover's powder, aided by warm drinks and warm applications to the ear. From three to twelve drops of laudanum, according to the age of the patient, should be introduced, tepid, into the affected organ, where it should be retained by means of raw cotton and a proper position of the head. When the distress is very violent and the ordinary remedies fail, leeches should be applied behind the ear, and the bowels opened by a brisk cathartic, followed by an efficient diaphoretic.

When the disease is of a strictly neuralgic character, as denoted by the peculiarity of the symptoms, the best remedies will be quinine, either alone, or in union with strychnine, arsenious acid, and morphia. When it is dependent upon gout or rheumatism, colchicum will be of service.

## CHAPTER VI.

## INJURIES AND DISEASES OF THE NOSE AND ITS CAVITIES.

THE nose is subject to various affections. The most common are hemorrhage, ulceration, polyps, hypertrophy of the mucous membrane, certain malformations, and foreign bodies.

1. *Hemorrhage*.—The mucous membrane of the nose, from its great vascularity, is a frequent seat of hemorrhage. The exciting cause may be external violence, as a blow, with or without fracture of the nasal bones, or mere plethora of the system, nature endeavoring to find a spontaneous outlet for the redundant fluid. Young persons, of both sexes, are particularly prone to this discharge, about the period of puberty. Occasionally the flow is vicarious of the menstrual flux. The amount of bleeding varies in different instances, from a few drachms to a number of ounces. In the latter case, and especially when the discharge is of frequent recurrence, excessive debility, and even loss of life, may be the result. The blood generally proceeds from one nostril only; very rarely from both.

The milder forms of nasal hemorrhage require no special interference; nor does the practitioner interpose his authority when the discharge is vicarious, or an effort of nature to rid the system of an undue supply of blood. It is only when the discharge is very abundant, or slight, yet so frequent in its recurrence as to tend to injurious consequences, that an attempt should be made to suppress it. With this view perfect quietude of mind and body is enjoined, the head and shoulders are thoroughly elevated, and all stimulants, whether in the form of food or drink, are interdicted. A large bladder, partially filled with pounded ice, or a refrigerating lotion, is applied to the head and nape of the neck, and a lump of ice, enveloped in flannel, to the nose. Sometimes a small piece of ice may advantageously be inserted into the affected nostril, or held against the roof of the mouth. Along with these means the patient takes, every three hours, two grains of opium and two of acetate of lead, until the system has become fully impressed with the narcotic, when it may be either entirely suspended, or administered in smaller quantities, and at longer intervals. One of the most important indications, in this and all other hemorrhages, is to quiet the heart's action, and there is no medicine so well calculated to do this as opium. To produce the desired effect it should be given in full doses, repeated from time to time, as circumstances may require. When there is reason to believe that there is a want of coagulability of the blood, the best remedies will be perchloride of iron, or, what I

like equally well, the tannate of that salt, the dose of the former being three grains, and of the latter, five or six every three or four hours. The bowels are, of course, not neglected; and where the bleeding is connected with, or dependent upon, actual plethora, blood is taken freely from the arm, on the principle of derivation and direct diminution of vascular supply. Hot pediluvia, diaphoretics, and vesication of the neck are sometimes eminently serviceable.

When the above measures fail, or when as much blood has already been lost as the system can bear, direct interference by obstructive means is required, and that without delay. The patient being supported upon the edge of the bed, in the semi-erect posture, a double wire, very thin and flexible, and composed either of silver or iron, is passed along the floor of the nostril into the fauces, where it is to be seized with the finger introduced into the mouth. A strong double ligature, tied over a piece of soft sponge, or a roll of cotton, charpie, or patent lint, is then secured to the loop, and drawn up into the nose by retracting the wire. The finger being still in the mouth assists in carrying the tampon round the palate and in adjusting it in the posterior orifice of the naris. The wire is now detached, when the operation is completed by tying the ends of the thread over another plug in front. Both outlets being thus effectually occluded, the hemorrhage must necessarily cease as soon as the nasal cavity is filled with blood, which thus serves to compress and control the bleeding vessels. The parts are not disturbed until the end of the third day, when the tampons are removed, and the nasal cavity washed out with some mildly astringent lotion, introduced with the syringe.

When no wire is at hand, the operation of plugging the nose may be performed with a gum-elastic catheter, a piece of whalebone, or a stick of wood; in fact, with almost anything. The best contrivance, however, of all, is that represented in the adjoining cut (fig. 252), and

Fig. 252.



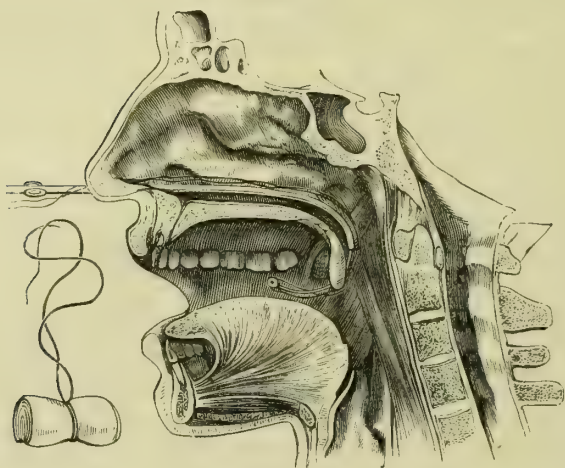
Bellocq's cannula.

known as Bellocq's instrument. It consists of a silver tube, about six inches long, containing a movable rod of nearly the same length, with a steel spring surmounted by a silver knob, with a hole in its centre for the attachment of the ligature which holds the posterior tampon. The instrument is one of the most perfect imaginable, and should find a place in every surgeon's armamentarium. The adjoining cut (fig. 253), exhibits the manner of applying it.

With any of the means now described the operation in question may always be promptly and safely performed, and the practitioner who allows his patient to bleed to death from such a cause should, provided he has had a fair opportunity of exerting his skill, be held



Fig. 253.



Plugging of the nose.

personally responsible for his life. I have seen one man, full of health, and in the prime of existence, perish from nasal hemorrhage, which might have been easily arrested by this simple procedure.

2. *Ulceration*.—Ulcers of the nose, chiefly of a strumous and syphilitic nature, are sufficiently common, and from their rebellious character, and fetid discharges, are often a source of great annoyance, both to the patient and the practitioner. Seated originally in the mucous membrane, they gradually extend in depth, until, in many cases, they involve all the component structures, cartilage and bone, as well as fibrous tissue. The disease generally commences high up in the nose, beyond the reach of the eye of the observer; but not unfrequently its first effects are displayed upon the inferior turbinated bone, or the nasal septum. In the strumous variety one side alone may suffer, whereas in the syphilitic nearly always both are implicated. Both forms are often met with early in life, and hence it is by no means always easy to distinguish them from each other. Perhaps, the most important diagnostic characters are that, in syphilitic ulceration, there is, ordinarily, greater derangement of the general health, more extensive involvement of structure, and more abundant discharge, than in the strumous variety. Useful information may also commonly be derived from the history of the case and the temperament of the patient, though the latter is frequently of negative value, as scrofula and syphilis may co-exist.

The discharge attendant on this disease is noted for the intensity of its feter, whence the term *ozæna*, by which the affection is usually designated. It is generally of a thin, sanious nature, irritating, and profuse, requiring the frequent use of the handkerchief, rendering the poor sufferer disagreeable both to himself and to his neighbors. During sleep it often descends into the fauces and the stomach, causing nausea and sometimes even vomiting. In the more aggravated forms of the affection large quantities of inspissated mucus pass off, or, collecting in

the nasal cavities, form thick, brownish incrustations, which drop off every fourth, fifth, or sixth day, only to be succeeded by another crop. Portions of cartilage and bone, or even entire bones, often die, and slough away. In syphilitic ulceration, more frequently than in the strumous, the ravages of the disease often extend to the proper bones of the nose and palate, and occasionally even to those of the face; eventuating in horrible and irremediable deformity.

The *treatment* of ozæna must be regulated by the nature of the exciting cause. This, therefore, should always, if possible, be determined as a preliminary step. It should not be forgotten that a bloody and fetid discharge may proceed from the nose in consequence merely of the presence of a foreign body, retained secretion, or disorder of the general health. Such cases are managed on general principles; they require no specific remedies. But it is otherwise when the disease is dependent upon a tainted state of the system. Here a long course of treatment, involving the exercise of much patience on the part of the sufferer, and great skill on the part of the surgeon is usually necessary. Where the strumous character of the malady is well settled, the different preparations of iodine, barium, and cod-liver oil are brought into requisition. If, on the contrary, there is reason to believe that the disease has been induced by syphilis, mercury and iodide of potassium should be employed, to an extent commensurate with the exigencies of each particular case. During the height of the morbid action, leeches and active purgation, with full doses of opium, may be demanded. In a majority of instances, however, stimulants, and not depletents, are necessary, as is evident from the pallor of the countenance, and the emaciated condition of the frame.

To allay fœtor, and assist in establishing healthy action in the affected parts, various lotions are employed. The best are chlorinate of soda, and solutions of nitric acid, nitrate of silver, and sulphate of copper. These fluids, properly tempered, are thrown twice a day into the nostril with a large syringe, the head being held forward over a basin, and thorough contact of the liquid with the inflamed surface being effected at each operation. The rule is not to permit the injection, in any case, to smart beyond a minute, and as one article becomes inert, to substitute another. The black and yellow washes, as they are termed, and which are so useful in certain forms of syphilitic ulcers in other parts of the body, are objectionable in this, on account of their liability to descend into the stomach, and thus lead to ptyalism. For many years past I have been in the habit of employing, with signal benefit, in both varieties of the disease under consideration, a solution of sulphate of copper and tannin, in the proportion of one-fourth of a grain of the former and three grains of the latter to the ounce of water. When there is much fœtor, a small quantity of chlorinate of soda may advantageously be added to the other ingredients. When the diseased spot can be reached, as it may when it is seated in the anterior and inferior part of the nose, the nitrate of silver and sulphate of copper may be applied in substance, or the sore may be touched very lightly with the dilute acid nitrate of mercury. Some of the milder

unguents, as the citrine and calamine, may prove serviceable by softening the scabs, and promoting healthy granulation.

3. *Hypertrophy*.—Hypertrophy of the mucous membrane of the nose is observed chiefly in children and young persons of a weakly, strumous constitution. Its most common site is the anterior extremity of the inferior turbinated bone; it consists in an enlarged and thickened state of the mucous tissues, dependent upon a process of hypernutrition, along with effusion of sero-plastic matter. The subjacent bone occasionally participates in the disease, becoming soft, porous, and expanded. Upon looking into the nostril with the aid of a strong light, the part presents the appearance of a small tumor, of a scarlet color, and of a spongy consistence, with numerous little vessels ramifying over its surface. It is generally of slow development, and the only inconvenience which it produces is its mechanical obstruction, which is sometimes so great as to lead to considerable embarrassment of breathing in the corresponding cavity. Both nostrils occasionally suffer, though seldom in an equal degree. The only affection with which it is liable to be confounded is polyp, but from this it is always easily distinguished by its site, scarlet color, and fixedness. The disease may continue, with perhaps little change, for years, and finally disappears spontaneously. The remedies best adapted to its cure are purgatives and the different preparations of iodine, especially the iodide of iron, with an occasional leech to the part, and the semi-weekly application of the solid nitrate of silver. Punctures and astringent lotions are sometimes beneficial.

4. *Malformations*.—The most important malformation of the nose, surgically considered, relates to its septum. It consists of a kind of lateral curvature of the cartilaginous portion of the septum, with or without hypertrophy of its anterior extremity. In consequence of this arrangement, the corresponding cavity is diminished in size, and the opposite one proportionably enlarged. Cases occur in which the obstruction thus produced amounts almost to complete occlusion, the patient being obliged to breathe nearly entirely through the unaffected nostril. The only remedy for this affection is excision of a portion of the offending septum, care being taken to avoid perforating it. The best instrument for performing the operation is a narrow, probe-pointed bistoury, with which the necessary slicing is safely and expeditiously executed. When the obstruction is seated at the very orifice of the nostril, a tolerably extensive dissection may be required in order to effect the desired object.

5. *Calculi*.—Nasal calculi, technically termed rhinoliths, are very infrequent; they are usually situated in the inferior meatus, are of an irregular shape, and vary from the volume of a pea to that of a pigeon's egg. Their surface is rough, and they are of a black, gray, or brown color, their centre often consisting of some foreign body, as the root of a tooth, a bead, or a cherry-stone. Their composition is phosphate and carbonate of lime, cemented by animal matter. These calculi are usually solitary, but sometimes they are multiple, and instances occur, though rarely, in which they form in each nostril. Their presence is productive of the usual symptoms of obstruction of the nose, with more



or less discharge of a sanious and fetid character. When of considerable bulk, they may cause a good deal of pain and inflammation in the neighboring structures. Simple inspection of the nostril generally suffices to detect them; when this fails, a probe is introduced, which, on coming in contact with the extraneous body, produces a characteristic click, not unlike what results from the contact of a sound with a vesical calculus. Extraction is accomplished with a hook, bent probe, or polypus-forceps; or, the attempt being unsuccessful, the concretion is pushed into the fauces, a finger being previously placed there to receive it. Sometimes expulsion is effected during a fit of sneezing.

6. *Foreign Bodies*.—Various substances may find their way into the nasal cavities of children, being generally placed there as a matter of amusement. The most common of these are grains of corn, peas, beans, beads, pellets of paper, buttons, fruit stones, rags, and pieces of ribbon. If allowed to remain for any length of time, they always induce inflammation, and sometimes even ulceration of the lining membrane, with more or less pain, and a sanious, fetid discharge. Their common site is the anterior portion of the nostril, between the turbinated bone and the nasal septum, where they are often firmly impacted, and consequently difficult of spontaneous extrusion. Should the child, or some other inexperienced person, attempt extraction, as too often happens in such cases, the foreign substance will only be pushed farther in, and in this way it frequently passes entirely beyond the reach of the sight, being arrested, perhaps, pretty high up in the cavity, or forced against the floor of the inferior meatus.

Whatever the foreign body may be, it should always, for the reasons above mentioned, be extracted as speedily as possible. If the child is sufficiently old to co-operate with the surgeon, he is requested to take a pinch of snuff, and, during the effort of sneezing which is sure to follow, expulsion is often promptly effected, especially if care be taken at the same time to occlude the sound nostril by means of the finger. If the substance obstructs the passage completely, it may often be promptly dislodged by insufflation. For this purpose the unaffected nostril is closed by external pressure, when the surgeon blows forcibly with his own mouth into the mouth of the patient, the current of air thus established being sufficient to cause extrusion. In general, however, the removal of the foreign body is easily enough effected with a small flexible, blunt, double hook, a probe bent at the end, or a piece of annealed wire, formed into a loop. The patient being in a strong light with the head inclined somewhat backwards, the instrument is carried obliquely upwards, on a line with the external nose, above and behind the foreign body, which is then extruded by a kind of jerking movement of the hand. The great fault usually committed by the surgeon in his attempts at extraction, is that he inclines the instrument too horizontally, whereby he is sure to push the intruder only farther into the nostril.

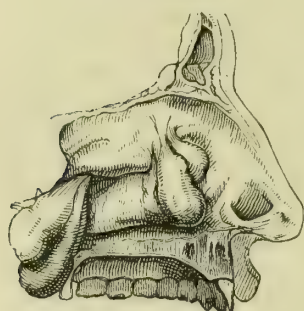
When the extraneous substance is out of sight, it may be necessary to push it down into the throat, or to wash it away with a stream of water from a syringe. Finally, it may be proper, in order to effect extraction, in the event of the patient being very fractious and unruly,

to give him chloroform; or, if this be objectionable, to secure his body with a stout apron, as in the operation for hare-lip.

7. *Polyps*.—The nose is a frequent seat of polyps, more so, in fact, than any other mucous cavity of the body. Several varieties of these morbid growths have been described by authors, but without any foundation in nature; for there are, in truth, only two, the gelatinoid and fibrous, which possess sufficiently distinctive characters to entitle them to separate consideration.

The *gelatinoid polyp* (fig. 254), resembles, as its name imports, a mass of jelly, or, more closely still, a common oyster. It is of a soft, spongy consistence, of a white, greenish color, somewhat translucent, and invested by a prolongation of the mucous membrane. Its surface, which is generally smooth, or smooth at one point, and rugose

Fig. 254.



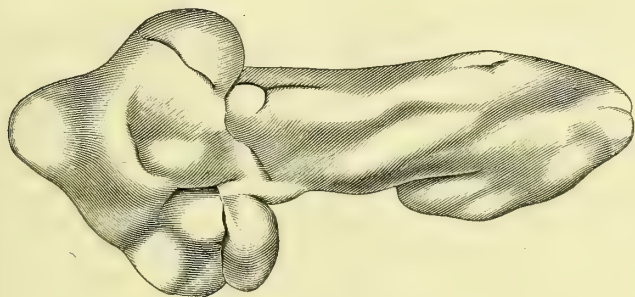
at another, nearly always presents a few small, straggling vessels, which serve to impart to it a peculiar striated appearance. In its shape the tumor is ordinarily somewhat pyriform, its attachment being by a narrow pedicle, while the broad, bulbous portion hangs downwards and forwards into the nostril. It almost constantly takes its rise from the superior turbinated bone; and sometimes exists in great numbers, though occasionally it is solitary. When carefully examined, it is observed to consist of a cellulo-fibrous substance, the cavities of which are occupied by a sero-

albuminous fluid, much of which drains off on puncturing the investing membrane. Owing to this peculiarity of structure, the tumor is of hydrometric character, expanding in damp, foggy weather, and shrinking in dry. It is void of sensibility, breaks easily under pressure, is most common in persons after the age of forty, and frequently exists simultaneously in both nares. Its volume is usually diminutive. A polyp of this kind occasionally contains fibro-cartilaginous concretions, as in a specimen in my private collection, taken from an elderly gentleman.

The *fibrous polyp* occurs at nearly every period of life; I have seen it in children under fourteen years of age, in adults, and in old people. More rare than the gelatinoid variety, it generally exists singly, is very prone to reappear after removal, and often exhibits a malignant tendency. It is ordinarily attached by a broad base to the superior turbinated bone, but occasionally it springs from the septum, floor, or wall of the nose. In the majority of the cases that have fallen under my notice, it was situated in the posterior part of the nostril, so as to be distinctly perceptible in the throat. Both sides may suffer simultaneously, but this is the exception, not the rule. The structure of the tumor is characteristic; it is composed of fibres, of a white, glistening color, exceedingly firm and tough, closely knit together, and most intricately arranged. Interspersed among these fibres are numerous vessels, both arterial and venous, the walls of which are very brittle,

and, therefore, liable to give way under the most trifling accident. Owing to this circumstance, this form of polyp is the seat of frequent, and, at times, of profuse hemorrhages. For the same reason, it is always, in its recent state, of a dark red, purple, or modena color. When permitted to pursue its course, the tumor may acquire an enormous bulk, descending into the throat, protruding externally, and pressing against the walls of the nasal cavities in every direction. At this stage of the disease, the features are often frightfully disfigured, presenting that peculiar appearance denominated "frog's face." The annexed cut (fig. 255), from a specimen in my possession, exhibits a well-marked example of the fibrous polyp.

Fig. 255.



The *symptoms* of polyp are such as attend obstruction of the nose from any other cause. The first intimation which the patient ordinarily has of the disease is a sense of fulness and weight in one of the nostrils; he feels as if there were some fleshy substance in it, interfering with the transmission of air, and, as a necessary consequence, he makes frequent and abortive efforts to clear his nose, using his handkerchief, perhaps, every half hour. Gradually he observes some discharge, at first of a mucous, then of a purulent, and finally of a sanious character, fetid, and profuse. The voice seldom remains natural; generally it is nasal, indistinct, and even snuffing; the sleep is embarrassed, and attended with loud snoring, the head being thrown back as in enlargement of the tonsils; the nose is blown with difficulty, and, during every effort of the kind, most of the contents of the nostril are forcibly projected into the fauces; the sense of smell is materially impaired; and eventually, as the growth spreads, the affected cavity is completely deprived of its functions. At this advanced stage of the disease, the patient occasionally experiences lachrymation from the pressure of the tumor on the nasal duct; partial deafness, from pressure on the Eustachian tube; and slight dizziness, from pressure on the jugular vein.

The symptoms above enumerated are, unfortunately, not characteristic; they may be, and often are, simulated by other affections. Thus, the person may labor under enlargement of one of the turbinated bones, hypertrophy of the mucous membrane, malposition of the nasal septum, or malignant disease, either of the nose itself, or of the maxillary sinus; or, finally, there may be a foreign body in the nose,



causing serious obstruction, and profuse, sanious, and fetid discharge. To make sure of the diagnosis, the polyp must be seen or felt. Protrusion at either opening of the nose at once decides the matter; but, in the absence of this, a careful inspection is made with the speculum, in a strong light, with the head inclined backwards; a grooved director is used, if necessary, to move the tumor about, and determine its size, consistence, and point of attachment. If the tumor is covered with mucus, clearance is first effected by blowing the nose, or, this failing, by means of a pellet of cotton, wrapped round the end of a probe. When the polyp lies far back it may project into the fauces, and thus satisfactorily reveal its character; should it not yet have descended, the index finger is introduced into the mouth, and carefully carried round the velum of the palate.

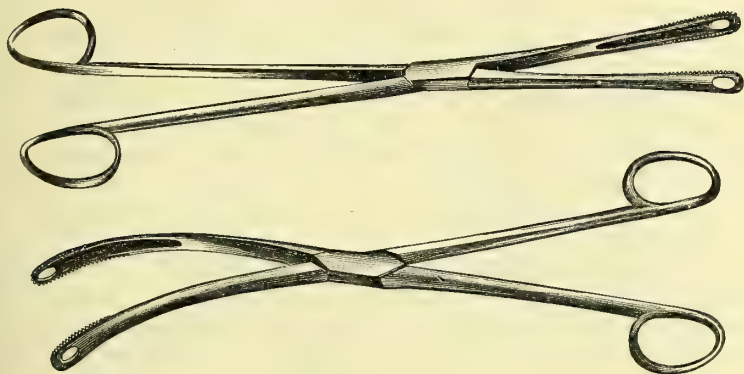
There are several circumstances which generally serve to distinguish a gelatinoid from a fibrous polyp. In the first place they differ essentially in their complexion; the former being always white, like an oyster, a lump of mucus, or a mass of jelly, while the latter is of a deep red, purple, or modena color. Secondly, the gelatinoid polyp is generally smaller, and, consequently, its existence less marked in dry than in damp weather, which is not the case with the fibrous tumor, which is not affected by atmospheric vicissitudes of any kind. Thirdly, the discharge is always less profuse, less offensive, and less bloody in the gelatinoid, than in the other form of the disease; and finally, there is rarely any involvement of the general health in the former affection, while in the latter it seldom escapes, especially in the advanced stages. There is another circumstance which, perhaps, should not be omitted in this enumeration; it is, that the fibrous polyp usually grows much more rapidly than the other, and that it has a much greater tendency to encroach injuriously and disfiguringly upon the surrounding structures.

Of the *causes* of nasal polyps, nothing is known. The disease has often been ascribed, among other circumstances, to the effects of external injury, the employment of snuff, the habit of picking the nose, and the irritation of decayed teeth; but it is very questionable whether they are capable of exerting such an influence. However this may be, it is certain that most growths of this class are developed without any appreciable cause. Both sexes are liable to them, but males suffer much oftener than females. Both varieties of tumor may attain a large size in a few months; or, after having made some progress, remain stationary for an indefinite period. I have seen a gelatinoid polyp attain the volume of a hen's egg in less than a year.

There is no doubt that a gelatinoid polyp of the nose is occasionally amenable to local remedies; but the cures thus affected are uncommon, and cannot serve as rules of practice even in ordinary cases. The best plan, therefore, is never to waste any time in this way, but to proceed at once to the removal of the tumor. Fortunately, this is generally easily effected by torsion, with the forceps. The instruments which I have long used for this purpose are represented in the adjoining sketches (fig. 256). They are very light and slender, being seven inches and a half in length, and provided with large rings. The

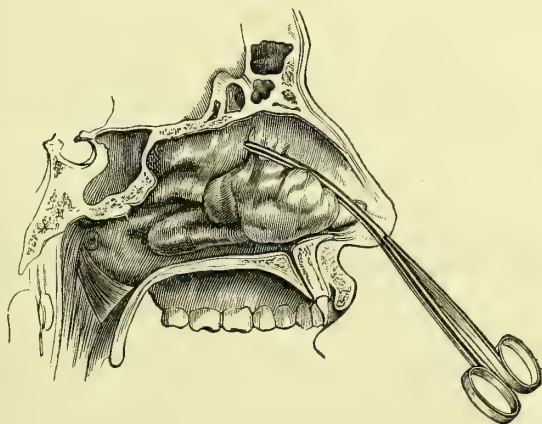
blades, which are nearly three inches long, are fenestrated, and grooved internally, with well serrated margins. The great fault of the common polypus-forceps is that it is too short and clumsy. When the tumor

Fig. 256.



is situated in the upper and back part of the nose, a curved instrument may sometimes be advantageously employed. The mode of applying the forceps is represented in the annexed cut (fig. 257).

Fig. 257.



The patient being seated upon a chair, in a strong light, with the head supported upon the breast of an assistant, the operator introduces the forceps as high as the origin of the tumor, which he then seizes by expanding the blades over its pedicle. Assuring himself that the instrument embraces nothing that ought not strictly to be within its grasp, he turns it gently upon its axis, or round and round, until he succeeds in detaching the morbid growth. Were he to attempt to pull it off, he might tear away not only the tumor, but, perhaps, also a large portion of mucous membrane, if not, also, even a part of one of the turbinated bones. The whole procedure should, therefore, be conducted in the most careful and gentle manner. If the first attempt

be unsuccessful, or if a part of the polyp is broken off, the instrument is reinserted, again and again, until the object is accomplished, not a particle of the growth being left behind. If more than one tumor exist, the others are dealt with in the same way, it being desirable, if possible, to effect complete clearance at one sitting. The blood which flows during the operation, and which has a tendency to conceal the polyp, is easily dislodged by blowing the nose, the sound nostril being compressed at the time to render the effort more effective. If riddance be impracticable in this wise, a stream of water, or vinegar and water, is thrown up with a large syringe. It is rarely necessary to suspend the operation on account of hemorrhage; the bleeding is usually slight, and nearly always ceases spontaneously in a few minutes. When it threatens to be copious and persistent, plugging of the nose may be proper.

When the tumor is situated far back in the nose, or hangs down into the fauces, it may occasionally be broken off with the index-finger of the right hand, introduced into the mouth, and carried round the palate. I promptly succeeded in removing, not long ago, in this way, a large gelatinoid polyp from a youth of seventeen; but I have no idea that the procedure would answer in the fibrous polyp, or even in a gelatinoid one with a broad base. In the case just adverted to, the tumor had a very narrow footstalk, attached to the posterior extremity of the inferior spongy bone, and, therefore, easily torn asunder. Nothing can be accomplished here with the forceps, however ingeniously curved and dexterously used; there is no space for their application. When, therefore, the means just described are unavailing, removal must be effected with the double canula and a stout silver wire (fig. 258). The instrument, which is four inches and a

Fig. 258.

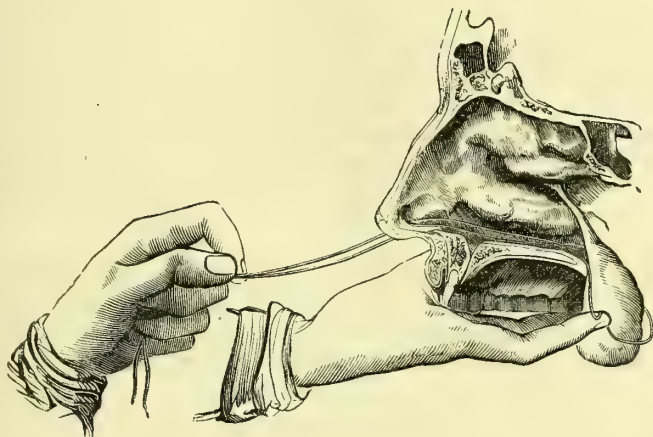


half in length, is conveyed along the floor of the nostril, as far as the fauces, when the loop of the wire is properly expanded, and passed round the neck of the tumor, as near as possible to its origin. The ends of the wire are then firmly but cautiously pulled, and secured to the shoulders of the canula. The annexed cut (fig. 259) exhibits the mode of applying the instrument. The strangulation is seldom effected under three or four days, and, in the meantime, it is necessary that the wire should be frequently tightened. When the polyp is nearly ready to drop off, the finger is introduced into the fauces, and the canula is rotated on its axis, to promote the separation, lest it should take place during sleep, and thus permit the tumor to pass into the windpipe or oesophagus. In the gelatinoid form of the disease, the safest and most expeditious plan is to twist the polyp off the moment it has been fairly embraced with the wire. I have occasionally succeeded in removing



fibrous polyps, when situated far back on the floor of the nose, or at the posterior nares, with an instrument shaped like a common chisel, not more than two lines in width, and beveled on one side at the ex-

Fig. 259.



tremity, so as to afford a semi-sharp edge. The growth is easily scraped off from its connections, especially if counter-pressure be made upon it with the index-finger in the fauces. The operation, however, is generally attended with a good deal of bleeding, rendering it occasionally necessary to resort to plugging of the nose.

When the fibrous polyp is of extraordinary bulk, and quite inaccessible by the means now pointed out, its removal can be effected only by the knife, or the knife and saw. When the disease is malignant, no operation should be attempted, not even with a view to temporary alleviation; much blood will be likely to be lost, the manipulations will be tedious and painful, and the patient may die on the table. Under opposite circumstances, the operation is performed at all hazards, and with a prospect of a favorable issue. An incision, in the form of an inverted  $\perp$ , is made along the junction of the nasal and maxillary bones, commencing just below the lachrymal sac, and terminating a little below the level of the nostril, the flaps being dissected up, and held asunder.

No particular treatment is required after the more common operations of this kind; there is usually very little inflammation or discharge, and in a few days the patient is able to go about his business. To prevent relapse, it is customary to inject the nose once a day with some astringent wash, as solutions of nitrate of silver, zinc, copper, or alum. The practice may, however, in general, be advantageously dispensed with; it is only when there is evidence of persistent morbid action that it is likely to prove beneficial. In the gelatinoid variety of the affection, where the tendency to regeneration is sometimes most remarkable, and also in the gregarious form of this disease, I have occasionally broken off as much as one-half, and even two thirds of

the implicated spongy bone, believing that this procedure was greatly preferable to the frequent repetition of the ordinary operation.

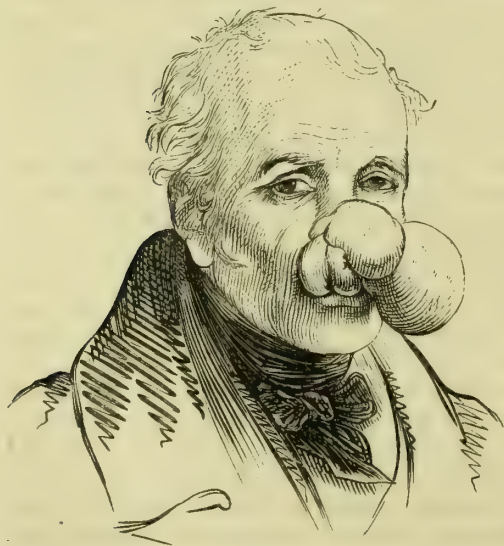
8. *Encephaloid*.—The nose is occasionally the seat of encephaloid; sometimes by extension from the maxillary sinus, but more generally by direct development; chiefly in children and young persons; marked by the usual local symptoms, and invariably tending to destruction. The tumor, which may spring from almost any part of the nasal cavity, is liable to be confounded with polyp; but from this it may commonly be readily distinguished by the remarkable rapidity of its growth, by its disposition to encroach upon the surrounding structures, by the great abundance of the accompanying discharge, and by the early involvement of the constitution, as denoted by the cancerous cachexia. The tumor is very friable, and often bleeds profusely from the slightest injury.

The *treatment* is purely palliative, operative interference being entirely out of the question. By attention to cleanliness, a nourishing diet, and the use of opiates, the patient is rendered comparatively comfortable, and enabled to eke out his miserable existence.

#### LIPOMA OF THE NOSE.

There is a curious affection of the nose—so curious generally as to excite the risibility of the observer—to which the term lipoma is

Fig. 260.



applied, from the fact that it essentially consists in an accumulation of the subcutaneous adipose substance, along with marked hypertrophy of the integument. The drawing (fig. 260), borrowed from Liston, exhibits the disease in an extraordinary degree of development. The tumor has a lobulated appearance, or, more correctly speaking, it is composed of several distinct masses, having, seemingly, one common origin. The growth, which is always chronic and painless, is almost exclusively confined to elderly male subjects with a ruddy complexion and an active cap-

illary circulation, addicted to the pleasures of the table and to alcoholic potations. The chief inconvenience which it produces is of a mechanical character, obstructing vision, compressing the nostrils, and interfering with eating and drinking. Occasionally the surface becomes very red and inflamed, and may, in time, even ulcerate. The sebaceous glands

are occasionally much involved in the morbid action, being enlarged, obstructed, and transformed into distinct cysts.

The only remedy for this disease, when it has attained any considerable development, is excision; when small and of recent standing, removal may sometimes be effected by sorbefacient applications, especially the tincture of iodine, a change of the patient's habits, and the steady use of purgatives. When excision is determined upon, the surgeon may expect to encounter a good deal of hemorrhage, owing to the enlargement of the cutaneous and other vessels, but this may usually be effectually controlled by ligature and compression. Care should be taken not to inflict any injury upon the cartilages of the nose.

#### RHINOPLASTY.

The nose, in consequence of accident or disease, may be so impaired in its form and size as to require reconstruction by the aid of plastic surgery. The operation which is performed for this purpose is, accordingly, denominated rhinoplasty. The lesion for which, in this and other civilized countries, interference is usually demanded, is constitutional syphilis, or the joint action of syphilis and mercury, which often destroys nearly every portion of the nose, except, perhaps, a small vestige of the bridge, causing, thereby, the most hideous deformity. The horror and distress of the case are greatly increased when the ravages extend to the frontal sinuses, the lachrymal passages, the upper lip, the ethmoid and spongy bones, and the soft and hard palate; in the latter event, throwing the nose and mouth into one immense cavern, an occurrence which not only seriously affects the speech, but readily admits the passage of food and drink from the latter into the former.

The deformities of the nose requiring plastic interference may very properly be arranged under the following heads: 1. Loss of the entire organ, bones as well as soft parts. 2. Destruction of the whole or greater portion of the cartilages, the bridge remaining intact. 3. Mutilation of the tip, as when a small piece is cut or bitten off, including a part of both wings. 4. Loss of one wing, either alone or together with the nasal column. 5. Perforation of the nose, either on the top or at the side; in the latter case, with or without participation of the cheek. 6. Sinking of the organ from destruction of the cartilaginous septum of the nose, the soft structures being but little, if at all affected. 7. Loss of the column. 8. Mutilation of the nose and upper lip, or of the nose, lip, and cheek.

For the repair of these various defects, some of the nicest processes of the art and science of surgery are required; but, even with the very best skill that can be employed in their application, success is by no means always to be looked for; on the contrary, the surgeon will too often have occasion to lament the occurrence of some unexpected or unavoidable event which frustrates his hopes and disappoints the expectations of his patient. It is, therefore, of the greatest consequence, as stated in the general chapter on plastic surgery, that



everything should be done beforehand calculated to insure a favorable result. If the operation be entered upon heedlessly, and without due preparation of the part and system, failure will almost be certain.

The integument required for closing the chasm in the nose may be borrowed from the immediate vicinity of the organ, or from some distant part. In the Indian method, as the former proceeding is usually called, the flap is obtained either from the forehead, the cheek, the upper lip, or the nose itself, according to the exigencies of each particular case. In the other procedure, which bears the name of Taliacotius, in commemoration of its inventor, or the Italian method, from the country of his nativity, the operculum is taken from the arm. The operation, however, chiefly in consequence of the tedious and painful confinement of the head and limb, is now seldom employed, although instances now and then arise in which it may be had recourse to with great advantage.

When an entire nose is to be reconstructed, the Indian method certainly deserves the preference, provided it be possible to obtain the requisite amount of substance from the forehead. Supposing that everything is favorable to the operation, the first step will be to measure off the shape and size of the flap. For this purpose, the defective part should be replaced with a wax-mould, a piece of gutta percha, or a lump of dough, representing as accurately as possible the outline and dimensions of the original organ. A piece of soft leather is then stretched over the artificial nose, to the shape of which it is cut with great care, including the column, or central portion. Another piece of leather, one-third larger than the former, is then fashioned, this addition being necessary to provide against shrinkage, which, in time, generally fully reaches this extent, if it does not exceed it. As a general rule, it may be stated that the flap should be from two inches and three-quarters to three inches in length, by two inches and a half in width at its widest part. In this length is included the column, which should be about one inch and a quarter in length, and from six to eight lines in width, according to the breadth of the nostrils. When the column is borrowed from the upper lip, the caudiform portion of the flap is of course omitted. The pedicle of the new nose must be from six to nine lines in width, and so long as not to displace the left eyebrow when it comes to be twisted upon itself, which, for the sake of convenience rather than anything else, usually is from left to right. The shape and size of the flap are to be carefully mapped off, just before the operation, with tincture of iodine, the preference being always given to the central portion of the forehead, unless there are contra-indications, in which event it should be taken from one side. The shape of the flap, and the manner of forming it, are shown at page 490.

These preliminaries having been gone through with, the patient, placed recumbent, with the head and shoulders gently elevated, is put under the influence of chloroform, it being desirable that he should be as passive as possible during the operation. A roll of lint being now inserted into each nostril, to prevent the ingress of blood, an incision is made, with a very sharp, narrow scalpel, along the iodinated track.

The cut on the right side, is extended down, close along the brow, to the root of the nose, while on the left side, it reaches hardly as low as the level of the brow, being prolonged afterwards, if it should be deemed advisable. In performing this part of the operation, it is of the utmost importance not to interfere with the angular artery, as the vascular supply of the new nose will mainly depend upon its integrity. The parts are divided, at the first stroke of the instrument, down to the periosteum, which is left intact. The gap in the forehead being now sponged, and the bleeding arrested by ligature, its edges are immediately brought together by several points of the interrupted suture and adhesive strips, as little being permitted to remain open as possible.

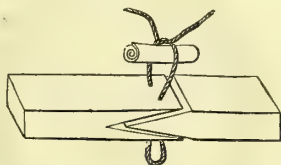
The next step of the operation consists in paring the edges of the mutilated organ, and removing such redundancies as may be in the way of the new material. The skin over the bridge of the nose should also be slightly revived in order to facilitate adhesion between the contiguous surfaces.

In the third step of the operation the parts are stitched together by the common interrupted suture; or, what is preferable, by the tongue and groove suture of Professor Pancoast. In order, however, to do this properly, it is necessary that the edges of the flap should have been previously beveled off on the cuticular surface for about the eighth of an inch, as may readily be done in the act of forming it by running the knife along obliquely. The edges of the nose are beveled from without inwards, so as to form a groove for the reception of the tongue, an arrangement which thus brings together four raw surfaces. The connection is effected by passing a loop of thread with two needles first through the inner lip of the groove, then through the base of the tongue, and lastly through the outer lip of the groove, all on the same

Fig. 261.



Fig. 262.



level. The ends of the thread are then tied over a thin roll of adhesive plaster, thereby forcing the tongue deep into the groove. The number of sutures on each side must vary from three to five, according to the extent of the wound. The annexed cuts will serve to convey a better idea of making this ingenious suture than any description, however elaborate. Fig. 261 exhibits the mode of introducing the thread, and fig. 262 the manner in which the tongue is received into the groove.

All that now remains is to fix the caudal portion of the flap, intended for the column, in its proper position, a procedure requiring great care and attention in order to secure its adhesion. For this purpose a deep transverse opening is made in the upper lip, at its junction with the natural septum of the nose, from three to five lines in

length, into which the extremity of the strip, previously divested of cuticle, is firmly implanted, a few points of suture being employed to keep it in place.

The lint inserted into each nostril, prior to the operation, is now replaced by a fresh tent of the same material, inclosing a small gutta-percha tube, to prevent the adhesion of the opposite surfaces, as well as to facilitate respiration. Narrow strips of isinglass plaster being stretched across the sides of the nose to effect more uniform approximation, the dressing is completed by applying a layer of charpie, wet with oil, along the line of suture, to prevent the edges from becoming dry and shrivelled. The greatest care is used that, while the contact is complete, there shall be no undue tension anywhere. The diet is light and cooling, the temperature of the room is regulated by the thermometer, and the head is well elevated by pillows. An anodyne is given immediately after the operation, and the dressing is not disturbed until the end of the third day. New tents are now introduced into the nose, and any sutures that are loose removed; otherwise they are not disturbed.

It occasionally happens that the pedicle of the flap is redundant, giving the upper part of the nose, especially on the left side, a full, unseemly appearance. When this is the case, the defect may be remedied by the removal of an elliptical portion of integument, care being taken not to perform the operation until the organ is perfectly capable of sustaining an independent existence.

The adjoining sketches afford a good idea of the success which often attends rhinoplasty, when properly executed. Fig. 263 exhibits the

Fig. 263.



Fig. 264.



appearance of the parts prior to the operation, and fig. 264 nearly twelve months afterwards. The operation was performed at the College Clinic, in 1856, with the aid of the tongue and groove suture, and the result has been, in every respect, most gratifying, the organ



remaining up to the present moment large and well shaped. It is proper to add that the flap was uncommonly large, as it always should be, and that it united throughout by the first intention.

The Italian operation has undergone several modifications. As originally executed by Taliacotius, and afterwards by his immediate disciples, it was a most tedious and trying procedure, well calculated to put severely to the test the patience both of the subject and the surgeon. The first step consisted in forming a suitable flap of integument at the inner and middle part of the left arm, over the flexor muscle, at least four inches in length by three and a half in width, its outline having been previously marked off with ink. Two longitudinal incisions being made, the integument was carefully raised in its entire extent, or as far as the two transverse lines, a piece of soft linen, well oiled, being afterwards passed beneath it to prevent reunion. The wound, which, in the modern process, is closed by suture under the bridge, was left to suppurate, and, at the end of a fortnight, the flap, now thickened, hardened, and shrunk, by exposure, and covered with granulations on its posterior surface, was liberated at its superior extremity, which was then accurately stitched to the mutilated organ, the edges of which had been previously revived for its reception. To prevent the sutures from giving way, the limb was brought up close to the head, and maintained in that position by an ingenious, but complex apparatus, consisting of a cap and jacket, made of strong drilling; the arrangement and mode of application of which may be easily understood from the adjoining sketch (fig. 265), copied from the original treatise of Taliacotius.

Another fortnight having been permitted to elapse, to afford the parts time for uniting, the flap was detached from its connection with the arm, and, after having been properly fashioned, accurately fixed in the position which it was destined to occupy.

Taliacotius has left no statistics of his rhinoplastic operations, and we are, therefore, left in ignorance as it regards his success. From the great care, however, with which he has described his process, and from the fact that he attended numerous patients from abroad, it is reasonable to conclude that his success was highly flattering. He was evidently a most ingenious and skilful surgeon, far in advance of his age; and in the operation of reconstructing noses he dwells with great force and point upon the importance of having the adscititious parts of unusual dimensions, thus providing against the effects of shrinkage, one of the great obstacles to the formation of a good organ.

Fig. 265.



Graefe, of Berlin, modified the operation of Taliacotius, by attaching the flap at once to the mutilated nose, thus limiting the period of the constrained position of the head and limb to five or six days, this being generally found sufficient to insure adhesion between the parts. The actual value of this process, now usually known as the German method, has not been fully tested, but my opinion is that, while it answers very well in some cases, it is, on the whole, inferior to the original plan, since it lessens the chances of reunion, and admits of a greater degree of shrinkage after the operation. In the Italian procedure, the new material, from its exposed situation, acquires a better circulation, as well as a greater degree of solidity and thickness, thereby fitting it the better for the maintenance of the new relations. That excellent operator, Dr. J. Mason Warren, of Boston, in one case, adopting the German modification of the Italian method, took his flap from the anterior surface of the forearm, about two inches above the wrist, and succeeded in effecting an admirable cure, the transplanted skin being separated on the fifth day.

Small apertures, of an oval or circular form, the result of wounds, ulceration, or gangrene, are met with on various parts of the nose, and may generally readily be closed by the transplantation of a flap either from the cheek, the forehead, or even the nose itself, according to the circumstances of the case. A similar procedure will be required when there is partial destruction of the edge of the nose. When one of the wings is lost, it will generally be necessary to borrow the flap from the arm or forehead. When the nasal column is deficient, an admirable substitute may easily be obtained from the central portion of the upper lip, either by twisting the flap at its pedicle, or by everting the mucous membrane, the surface of which soon assumes the character of the cuticular tissue.

The nose is sometimes unseemly depressed, or caved in, in consequence of the destruction of its cartilaginous septum, without perhaps any injury of the skin, giving it more or less of an African expression. For such a defect, the only remedy is the construction of a new organ, all attempts to elevate the parts in a satisfactory manner proving useless for the want of proper support.

## CHAPTER VII.

## DISEASES AND INJURIES OF THE AIR-PASSAGES.

THE principal surgical affections of the air-passages are inflammation and its effects, as œdema, croupous deposits, and ulceration; polypous growths; warty excrescences; spasm; stricture; and foreign bodies.

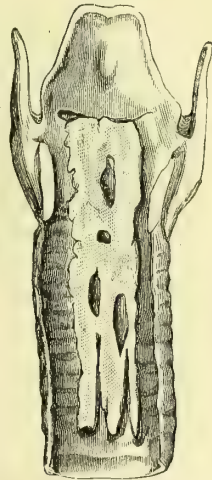
## 1. LARYNGITIS.

Inflammation of the larynx, or of the larynx and trachea, is an exceedingly common affection, the result usually of cold, of external violence, or of the inhalation of the steam of hot water, or the fumes of irritating gases. As generally met with, the disease is most common in young children, in whom it ordinarily assumes the form of croup, which occasionally manifests an endemic character, and is extremely liable to be followed by a deposit of plastic matter, accurately moulding itself to the interior of these canals, and closely adhering to their surface. In the more aggravated cases, the deposit extends, on the one hand, up into the throat, and, on the other, down into the bronchial tubes, thus causing great, if not fatal, mechanical obstruction to respiration. Fig. 266 exhibits this deposit as it occurred in one of my specimens, removed from a lad dead of croup.

For the relief of this affection, known as membranous croup, the aid of the knife is occasionally invoked; generally, however, merely as a dernier resort, and, consequently, when it is too late to be of any real benefit. Now and then, it is true, a patient is saved, but, in most instances, operative interference is utterly futile, as is proved by the fact that out of 351 cases of tracheotomy performed on account of this disease by twenty-one French surgeons, including a number of the most distinguished operators of Paris, 312 terminated fatally; thus affording a ratio of 8 deaths to 1 recovery. One of these surgeons operated forty times, and lost every one of his cases.

Laryngitis is sometimes caused by syphilis, generally as a tertiary lesion; but as this affection has been described in another part of the work, it is not necessary to reconsider it here. The disease is also

Fig. 266.



False membrane of croup.

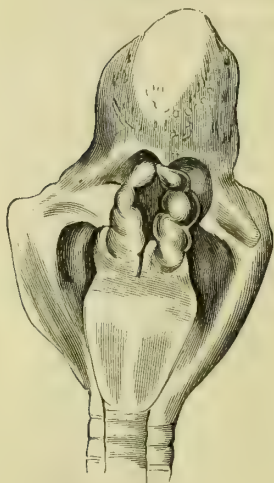


occasionally of a tubercular nature, and then nearly always passes into ulceration. Its co-existence with phthisis renders it nearly uniformly fatal.

## 2. ŒDEMA.

The larynx is liable to œdema. The parts which are most commonly affected are the glottis, the lips of the organ, and the epiglottis, the edges and under surface of which are usually thickened and pulpy. The disease consists in an effusion of serum, or serum and lymph, in the submucous cellular tissue of the parts, leading to mechanical obstruction of the tube, and serious impediment in the respiratory function. The swelling is devoid of vascularity, pits on pressure, and is generally most prominent round the margins of the larynx, which are often elevated into white, glossy, pendulous bags, not unlike those of the epidermis after the application of a blister. Small purulent depôts are sometimes seen in it, while its surface is occasionally incrustated with patches of lymph. The swelling is of a pale straw color, reddish, mottled, or greenish, and disappears almost completely when cut or punctured. The base of the tongue, pharynx, tonsils, uvula, and palate ordinarily participate in the morbid action, as is evinced by their inflamed condition. The mucous membrane of

Fig. 267.



Œdema of the glottis.

the larynx is heightened in color, and the lymphatic ganglions in the immediate vicinity of the tube are often enlarged, infiltrated, and softened. The adjoining cut (fig. 267), from a specimen in my collection, affords a good view of this disease.

Œdema of the larynx is usually insidious in its origin, and rapid in its progress, often terminating fatally in a few days. It is more common in men than in women, and is rarely observed before the age of puberty. In children it is sometimes induced by the inhalation of steam, or by drinking hot water from the spout of a tea-kettle. It often comes on suddenly, during the progress of other complaints, as scarlatina, measles, smallpox, tonsillitis, and typhoid fever, and is evidently of an inflammatory character, though its exciting cause is then seldom obvious.

The disease is marked by embarrassment of breathing, fits of coughing, change of voice, and threatened suffocation. Most commonly, the first indication is soreness of the throat, with a sense of constriction in the upper part of the larynx, as if there were a foreign body impacted in it. The voice is hoarse, sharp, hissing, or croupish; the cough is dry, sonorous, and convulsive; deglutition is painful; and the act of inspiration is performed with great difficulty and distress, while expiration is easy

and unembarrassed. The obstruction to the breathing seems to depend, not so much upon the diminished capacity of the larynx, as upon the manner in which the tumid and infiltrated lips of the organ are drawn in by the air, as it rushes from the mouth into the lungs. The dyspnoea steadily increases; every respiratory muscle is called into play; the head is retroverted; the shoulders are elevated; the countenance is anxious and livid, from the imperfect aëration of the blood; and the poor patient, harassed with frequent paroxysms of suffocation, at length dies exhausted. High fever is always present in the latter stages of the malady.

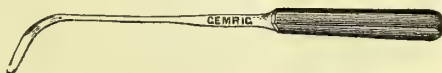
The distinctive *signs* of œdema of the glottis are, the difficulty of drawing the air into the lungs, the almost total absence of pain in the larynx, a feeling of fulness in the upper part of the throat, conveying the idea of the existence of an extraneous substance, soreness in the throat, and impediment in deglutition, often so great as to render it almost impossible to swallow either fluids or solids. In many cases, especially in females, in whom the distance between the lips and the affected parts is, in general, considerably less than in men, the end of the index-finger can easily be brought in contact with the elevated epiglottis and the swollen lips of the larynx. In young, restive subjects it may be necessary, in conducting the exploration, to depress the tongue with a spoon, and to separate the jaws with a piece of wood.

Too much attention cannot be bestowed upon the diagnosis of this disease, which is, unfortunately, too often overlooked. There are few practitioners who cannot recall cases of this kind, and who have not had reason to regret their want of early discrimination, while life was still within the reach of remedies. An error of this description is the more to be lamented, because it is almost always fatal to the poor sufferer, who is sure to be suffocated by the mechanical obstruction which the swollen parts offer to the ingress of the air. The period at which death occurs from this cause varies from forty-eight hours to three, four, or five days.

The *treatment* of œdema of the larynx consists of purgatives and emetics, and of leeches to the throat, followed by fomentations, and by blisters to the nape of the neck. General bleeding can only be required, or be proper, when the patient is young and plethoric. When the symptoms are urgent, the affected parts must be freely scarified, to afford vent to the effused fluids, the cause of the whole respiratory difficulty. For this purpose a long probe-pointed bistoury (fig. 268), with a short double-edged blade, bent at an angle of  $45^\circ$ , is carried into the larynx, and moved about in such a manner as to divide the tumid and infiltrated structures at different points of their extent.

The operation, which should be performed while the patient's head is thrown back, and firmly held by an assistant, the tongue being carefully depressed, and the jaws widely separated, is followed by hardly any bleeding, and is to be

Fig. 268.



Dr. Buck's knife for œdema of the larynx.

repeated at longer or shorter intervals, according to the amount of relief afforded.

The above treatment may often be advantageously aided by the nitrate of silver, a solution of which, in the proportion of twenty grains to the ounce of water, should be applied freely, not only to the larynx, but also to the surrounding parts, which, as before stated, are generally seriously involved in the inflammation. If these means fail, and the obstruction to the respiration steadily advances, our only resource is tracheotomy, an operation which has often succeeded in such cases, under circumstances apparently the most desperate. In an instance under my care in the winter of 1855, although great relief followed upon the operation, yet the patient, a female, fifty years of age, died on the third day, from inflammation of the lungs. The ingress of the air is promoted by the silver tube, or by means of hooks, as after tracheotomy for the removal of foreign bodies.

The treatment of œdema of the larynx by incision, the only effectual method when the disease has made any decided progress, was first placed in its true light in this country, by Dr. Buck, of New York, in 1848, in a paper in the first volume of the Transactions of the American Medical Association. The knife represented in the preceding cut, is his invention, and is admirably adapted to the object.

### 3. ULCERATION.

Ulcers of the larynx, of a common, tubercular, syphilitic, or mercurial origin, are not unfrequently met with. Commencing usually in the muciparous follicles, or in little abscesses beneath the lining membrane, they are irregularly circular in their shape, superficial, from one to two lines in diameter, and surrounded by thin, grayish edges. The mucous membrane in their immediate vicinity is generally softened and abnormally red, but now and then it appears to be entirely sound. The ulcers may occur in any situation; but the parts most commonly involved are the vocal cords, the glottis, the base of the arytenoid cartilages, the ventricles of Morgagni, and the epiglottis, the latter of which is particularly liable to suffer in secondary syphilis. Although they are ordinarily small and shallow, they sometimes occupy a large surface, or extend to a great depth, exhibiting a frightful appearance, and destroying, in their progress, muscles, ligaments, cartilages, and everything else that presents itself before them.

The *symptoms* of ulceration of the larynx vary according to the nature, seat, and extent of the lesion. The syphilitic form is, in general, the most severe, but the tubercular is also not unfrequently attended with much pain and distress. When the vocal cords, the ventricles, or arytenoid cartilages are involved, there will be a sense of heat and pricking in the larynx, hacking cough, a husky, wheezing, or whistling state of the voice, and difficulty of breathing, along with purulent and bloody expectoration. As the disease progresses the voice is reduced to a mere whisper, or becomes completely extinct, severe pain is experienced in the affected parts, hectic fever supervenes, and the patient finally dies from exhaustion of the vital powers, effusion upon

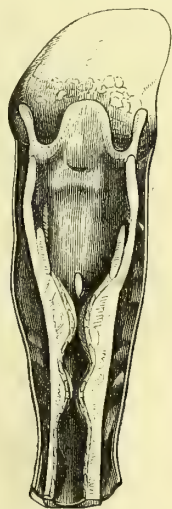


the lungs, or constitutional irritation. The suffering is greatly aggravated when the epiglottis is seriously implicated; for there is then not only dyspnœa, with cough and change of voice, but every attempt at deglutition is attended with great distress, if not with a feeling of instant suffocation. In the more advanced stages of the malady, whatever may be its character or situation, the difficulty of swallowing is often so extreme that life is essentially abridged by starvation, the patient being sometimes unable for days together to take even liquids.

Ulceration of the larynx is always a *dangerous* disease. If the more common forms are occasionally recovered from, the more aggravated nearly always prove fatal. This is particularly true of the syphilitic and tubercular varieties, very few cases of which, especially in their more advanced stages, are ever cured under any treatment. The latter is, as a general rule, even more dangerous than the former. Serious involvement of the muscles, ligaments, and cartilages is always denotive of great danger, whatever may be the nature of the exciting cause of the lesion.

It must be obvious that the *treatment* of a disease, depending upon so many and such various causes, and the diagnosis of which is so obscure, cannot be conducted with much prospect of permanent relief. Indeed, experience has shown that temporary amelioration alone is usually to be looked for. When there is reason to believe that the lesion is owing to a syphilitic taint, mercury, iodide of potassium, nitro-muriatic acid, sarsaparilla, and other kindred articles, must be employed. In ulceration, consequent upon tubercular deposits, little or nothing is to be expected from internal remedies, beyond the beneficial influence which they may exert upon the general health. In all cases, whatever may be the origin of the malady, permanent quietude of the affected organ is indispensable. Hence the patient must refrain from all conversation, and even, as far as practicable, from deglutition. When there is much pain, soreness, or tenderness in the parts, a few leeches may occasionally be applied to the front of the larynx, or the nape of the neck may be rendered raw with a blister. The best local remedy, however, is a solution of the nitrate of silver, in the proportion of from forty to fifty grains of the salt to the ounce of water, with which the ulcerated surface should be gently but efficiently touched every third, fourth, or fifth day, according to the tolerance of the parts, in the manner presently to be indicated. Should suffocation be threatened, laryngotomy may be performed, and a tube worn to facilitate respiration.

Fig. 269.



Double stricture of the trachea.

#### 4. STRICTURE.

Stricture of the windpipe (fig. 269) may be induced by a deposit of fibrin in the submucous cellular tissue, or, as is more frequently the case, by the contraction consequent upon a wound, the healing

of a large ulcer, or the death and exfoliation of a portion of one of its cartilages. Great diminution of the tube is occasionally produced by the pressure of an enlarged thyroid gland. The symptoms are those of impeded respiration, gradually increasing, and surely tending to the destruction of the patient. The diagnosis is established by the history of the case, and by a careful exploration of the tube with the probang. Relief may be attempted, though with hardly any prospect of success, by dilatation with the bougie, passed from the mouth, or from below upwards, through an opening in the trachea. The treatment is conducted on the same principle as in stricture of the urethra, œsophagus, and other outlets. When the parts are very irritable, cauterization precedes the dilatation; and when the latter operation is impracticable, on account of the intractableness of the patient, control is effected by anæsthesia. In desperate cases the trachea is laid open, and a silver tube worn. By such a procedure a patient may sometimes live in comparative comfort for many years.

### 5. POLYPS.

Polyps of the larynx are uncommon. They are of a globular, conical, or pyriform figure, and from the size of a small bean up to that of a pigeon's egg, a nutmeg, or even a large almond. Of a pale rose, red, or grayish color, they are of a fleshy consistence, more or less elastic, and invested by a prolongation of the mucous membrane. Microscopically examined, they are found to be composed of fibrous tissue, epithelial cells, and globules of fat. Their structure is, consequently entirely benign. They are generally attached by a thin, narrow pedicle to the ventricles of Morgagni, the vocal cords, the margins of the larynx, or the root of the epiglottis. Now and then an instance is

Fig. 270.



met with in which they spring from a very broad base. They occur in both sexes, and they have been most frequently noticed in phthisical subjects, after the fiftieth year. Their existence is indicated by a sense of constriction in the larynx, alteration and even entire extinction of the voice, occasional dyspnoea, and violent attacks of suffocation, especially when the morbid growth changes its position. A careful exploration, both by sight and touch, will be of essential service in determining the diagnosis.

The annexed drawing (fig. 270), from a specimen in my collection, exhibits a well-marked growth of this kind, developed in a man thirty-eight years of age, who finally died of tubercular ulceration of the larynx, in a state of profound marasmus. The tumor was about the size of a filbert, and of a fibro-cellular structure;

it hung down by a rather narrow pedicle into the lower part of the tube. No suspicion of its presence had been entertained during life.

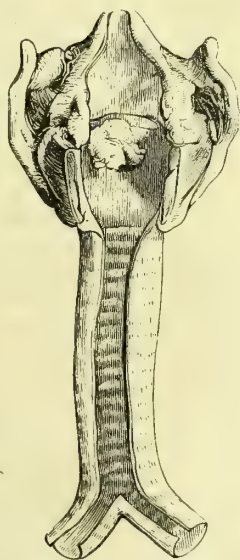
Great attention has lately been paid to the study of polyps of the windpipe, principally through the writings of Professor Ehrmann, of Strasburg, who, in an able and beautiful monograph, published in 1850, collected all the facts then known upon the subject. In this country it has also been ably treated by Dr. Green, Dr. Buck, and Dr. Willard Parker. The paper of Dr. Buck, inserted in the sixth volume of the Transactions of the American Medical Association, comprises a tabular view of 42 cases of morbid growths within the larynx. Of 38 cases, in which the sex is stated, 27 were males and 11 were females. The ages ranged from 2 years to 65, nearly one-half occurring in young subjects. The disease, if left to itself, is almost necessarily fatal. Of the 42 cases analyzed by the New York surgeon, only one was relieved by spontaneous expulsion. The majority perish from suffocation.

The only remedy for these morbid growths is excision. When the tumor projects above the larynx it may be seized with a pair of polypus-forceps, and snipped off with the scissors. If, on the contrary, it is imprisoned in the tube, it will be necessary to divide the cricothyroid ligament, together with one or both of the contiguous cartilages, so as to afford full and satisfactory access to the morbid growth. After removal has been effected, repullulation must be prevented by the occasional application of nitrate of silver, or chromic acid.

#### 6. WARTY EXCRESCENCES.

Warty excrescences (fig. 271), similar to those of the vulva and penis, are sometimes found in the larynx. They are of a pale reddish or grayish color, of a soft, fleshy consistence, and of a rounded, ovoidal, or conical figure. Their surface is rough and fissured, like that of a cauliflower; their length varies from half a line to a quarter of an inch; and their attachment is either by a narrow pedicle or a broad base, more generally the latter. These vegetations are usually associated with thickening of the lining membrane of the tube, and are nearly always dependent upon a syphilitic taint of the system. There are no distinctive signs of the disease. The history of the case, the altered state of the voice, and the feeling of uneasiness or of constriction at the top of the larynx, must serve to guide us in our diagnosis. In an old gentleman of sixty, who was under my care with this affection some years ago, the most prominent symptom was difficulty of swallowing fluids, owing to the indurated and contracted condition of the epiglottis, which felt as hard as a piece of wood. Anti-syphilitic remedies, counter-irritation in front of the neck by blister, seton, or pustula-

Fig. 271.



Warts in the larynx; growing in the situation of the vocal cords.



tion, and cauterization of the interior of the tube, constitute our chief resources in the treatment of this affection. They should be persevered in for a long time. When the excrescences are large and numerous, the obstruction may be so great as to demand tracheotomy and the constant use of the silver canula.

#### 7. SPASM.

Spasm of the larynx, or of the larynx and trachea, may be produced by a great variety of causes, some of them directly connected with the air-passages, and others indirectly, consisting, perhaps, in some disease of the brain or spinal cord, or some functional disorder of the stomach, bowels, or uterus.

Persons are sometimes instantly suffocated from the ingress of a foreign body into the windpipe, or from its lodgment upon the rima of the glottis. In such a case, the respiration may be permanently arrested in a moment, in the twinkling of an eye, as effectually as from the administration of prussic acid, or a severe blow upon the head.

Drunken persons occasionally die in the same manner, during attempts at vomiting. In the exhausted condition of the system, consequent upon the inordinate use of ardent spirits, the contents of the stomach are lazily ejected, thus allowing some of the ingesta, as they proceed upwards, to lodge against the rima of the glottis, or even to descend into the windpipe.

Diseases of the epiglottis, disqualifying it for the due performance of its functions, remarkably predispose to this occurrence.

The effect of the passage of a drop of water into the larynx is familiar to every one. All fluids, however simple, are capable, when introduced into this tube, of exciting the most violent, spasmodic, and suffocative cough; but the impression is evanescent, for the reason that liquids can produce no mechanical obstruction to respiration. The moment the spasm subsides the breathing is re-established. All solid articles, on the contrary, whatever may be their character, will, by entering the windpipe, or resting against the mouth of the larynx, endanger life by suffocation.

A person laboring under delirium tremens, and confined so as to be unable to move, may, in an effort at vomiting, instantaneously perish from the introduction of food into the air-passages. Many such cases, it is to be feared, occur in practice, without the real cause of the dissolution being always known.

Suffocation is occasionally produced by the sudden ingress of blood into the windpipe. This sometimes happens during operations upon the mouth and throat, and even during the performance of tracheotomy itself.

Violent, and, indeed, fatal effects are occasionally produced by the impaction of foreign bodies in the pharynx and œsophagus. In most cases, the bad effects are caused by the spasm which the extraneous substance induces in the muscles of the larynx; but occasionally they proceed from sheer mechanical obstruction.

In the *treatment* of spasmodic affections of the air-passages, careful inquiry must be made into the nature of the exciting cause, for it is only by doing this that the practitioner can hope to devise a rational plan of cure. The general health, if at fault, must be amended, the secretions corrected, and all sources of irritation, local and general, removed. As means of immediate or temporary relief, the most suitable remedies are anti-spasmodics, particularly chloroform, morphia, and valerian, with anodyne fomentations to the neck. If the case is urgent, threatening suffocation, the only resource is laryngotomy.

### 8. PARALYSIS.

Paralysis of the larynx and trachea may be caused by disease or accident; in the latter case usually by a blow or fall, eventuating in contusion of the muscular fibres of the tube, so as to disqualify it, in part, if not completely, for the exercise of its functions. The lesion is sometimes purely sympathetic, depending upon disorder of the brain, spinal cord, or digestive apparatus; and in this event, relief must obviously be sought in a correction of the antecedent evil. When caused by external violence, the symptoms may be of so urgent a character as to demand immediate recourse to bronchotomy.

### 9. FISTULE.

Fistule of the windpipe is occasionally congenital, but such an occurrence must be extremely uncommon, as I have never seen an instance of it, either in my own practice or in that of my friends. Most generally it is caused by wounds, refusing to heal in consequence of the overlapping of their edges, or the presence of some extraneous substance, as a piece of necrosed fibro-cartilage. Its size varies, of course, in different cases; usually, however, it is very diminutive, perhaps hardly as large as an ordinary pin's head. Its edges have a red, raw appearance, and there is usually a small quantity of mucous discharge, at once indicative of the real nature of the lesion.

When a fistule of the trachea has continued for a long time, the tube above the opening is very apt to become contracted, thus interfering materially with the cure of the case.

The *treatment* of this affection consists in paring the edges of the opening, both in the tube and in the integument, and in approximating them by several points of the interrupted suture. The milder cases occasionally yield to gentle cauterization with the solid nitrate of silver.

### 10. HERNIA OF THE TRACHEA.

The trachea is liable to protrusion of its lining membrane between two of its rings, constituting what has been, ridiculously enough, called bronchial hernia. It is usually caused by severe straining; either suddenly, as occasionally happens in violent labor from forcibly holding the breath, or gradually, in consequence of loud and habitual efforts with the voice. The tumor which is thus formed is remarkable

for its softness, and varies from the size of a pea to that of a pigeon's egg, increasing during exertion and diminishing under pressure. It produces no particular inconvenience, except what results from the disfigurement which it occasions. The proper remedy is steady, systematic compression, which, if it do not produce a cure, will, at all events, have the effect of preventing its farther increase.

### 11. CAUTERIZATION OF THE AIR-PASSAGES.

The treatment of affections of the air-passages by cauterization has attracted great attention within the last few years, both in this country and in Europe, chiefly through the exertions and influence of Dr. Horace Green, of New York. Unfortunate in the manner of its introduction, it has met with much opposition and even obloquy, and there are not wanting many able practitioners who altogether deny its practicability, alleging that the instrument employed for the purpose, when it descends beyond a certain point, is always thrust into the oesophagus instead of passing on into the air-tubes. On the other hand, the treatment has received the approval of some of the highest authorities in the profession, and there is reason to believe that it has already rendered important service in a class of diseases which, until its adoption, were generally found to be of a very hopeless character. The operation of mopping the windpipe is unquestionably not an easy one, but that it can be executed by any one of ordinary tact, and possessed of a correct knowledge of the anatomy of the parts, my observation abundantly attests. That the instrument is often passed down the oesophagus by awkward and ignorant practitioners is, I think, equally true. Experience is in this, as in every other operation requiring delicacy and skill, of vast benefit, and there is no doubt that he who enjoys it in the greatest degree is, all other things being equal, most likely to succeed in cauterizing the air-passages with facility and success. Dr. Green, unfortunately, as it seems to me, has attempted to carry this operation too far; it is easy to admit the possibility of conducting a probang into the larynx, but when it is asserted that the instrument may be safely conveyed into the lower portion of the trachea, into the bronchial tubes, and into pulmonary caverns, our faith is a good deal shaken, and not a few are ready to exclaim that the whole procedure is impracticable.

Cauterization of the larynx is particularly indicated in chronic affections of this tube, whether simple, syphilitic, or tubercular, or dependent upon the presence of warty excrescences. It is also very efficient in acute inflammation, especially in that variety of it denominated membranous croup. Aphonia, caused by disease of the larynx, is likewise a suitable case for its employment.

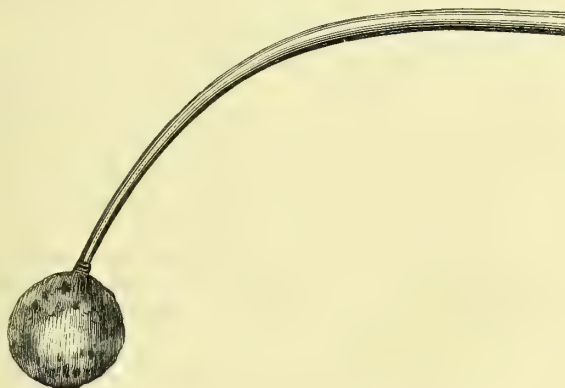
The article with which the cauterization is effected is the crystallized nitrate of silver, in the form of solution, in the proportion of from forty to sixty grains to the ounce of water. When ulceration is present, or when the medicine has ceased to produce the desired effect, the strength of the solution may be considerably increased; but for ordinary purposes this is unnecessary. The solid article is, of course, never em-



ployed, as it is not only too severe, but might do incalculable mischief if it were to break off, and fall into the windpipe.

The probang with which the application is made consists of a thick whalebone rod, furnished with a stout handle, and bent to an angle of nearly  $45^\circ$ , the curved extremity being surmounted by a small round piece of sponge, of great softness and delicacy, and firmly attached by means of a strong thread, to guard against its coming off (fig. 272).

Fig. 272.



Sponge-probang for the larynx.

The whole instrument is about ten inches in length. The sponge being slightly moistened with the caustic solution, the patient, seated upon a chair, is requested to open his mouth as widely as possible, and take a full inspiration, followed by a gentle expiration, thus placing the parts in the best condition for the easy introduction of the instrument, and the prevention of spasmodic cough. While this is being done, the surgeon depresses the tongue, and carries the probang over the top of the epiglottis, and thence suddenly on, over the lower surface of that cover, downwards and forwards through the mouth of the larynx, into the interior of that tube. A momentary contact is all that is necessary. The operation is generally followed by some cough, but this soon passes off, leaving the part and system comparatively comfortable. When the spasm is unusually great, threatening suffocation, I have found the best remedy to be the inhalation of a little chloroform, which usually affords almost instantaneous relief. The operation in chronic disease should not be repeated oftener than once every third or fourth day; in acute affections, on the contrary, it may be necessary to perform it once or even twice a day.

When the fauces and air-passages are very irritable, or the patient is uncommonly timid or unmanageable, it will be well, as suggested by Dr. Green, to institute a kind of preliminary treatment, consisting in the frequent application of the finger and of various instruments to the tongue and throat, so as to educate the parts for the approaching ordeal, just as we are obliged to do prior to the operation of staphylo-rhaphy. If the fauces are inflamed, they should at the same time be occasionally touched with nitrate of silver.

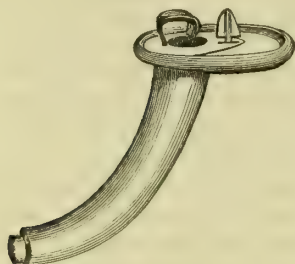
## 12. INTRODUCTION OF TUBES.

The introduction of tubes into the windpipe becomes necessary whenever that canal is opened for the purpose of promoting the ingress of the air, in cases of mechanical obstruction, however induced. The only exception to this rule is, or should be, when the respiratory difficulty is occasioned by the presence of a foreign body in the air-passages, and where, consequently, a tube, worn in the trachea might interfere with the expulsion of the substance.

Tubes of this kind are generally made of silver; they should possess the qualities of lightness and of accurate adaptation to the parts which they are destined to serve. Their length varies from an inch and a half to two inches and a quarter, according to the stature of the patient, and their diameter should be such as to admit of easy introduction, without at all encroaching upon the surface of the windpipe. Their shape is cylindrical, with a slight antero-posterior curvature, the concavity of which is directed forwards. The superior extremity of the instrument is provided with two rings, for the passage of tapes, which, being tied at the back part of the neck, thus secure it firmly in its place.

Most instruments of this kind are now made double (fig. 273), the inner one, which is nearly a fourth of an inch longer than the outer, being so constructed as to admit of easy removal for the purposes of cleanliness. This is a matter of paramount importance, as the tube soon becomes clogged with thick, tough, adherent mucus, thus rendering frequent withdrawal absolutely indispensable. Meanwhile, the outer instrument, or sheath, being retained, the introduction of the inner is thereby much facilitated; so that, in fact, the operation may readily be intrusted to any intelligent nurse, a great convenience, both in city and country practice. The two tubes are fastened together

Fig. 273.



Trachea tube.

by a button. The breathing-orifice should always be carefully covered over with a piece of gauze to prevent the ingress of flies and other extraneous substances.

When a tube is intended to be worn in the larynx, it will generally be necessary to remove an elliptical section of the crico-thyroid membrane, in order to afford sufficient room for its accommodation. Occasionally the object may be attained by a large crucial incision.

The length of time during which such an instrument should be worn must, of course, depend upon circumstances, or, more properly speaking, the necessity which led to its introduction. In some instances it may be dispensed with in a very short time, while in others it may require to be retained for years, if not during the remainder of life. Whenever the patient wishes to speak, he must place his finger upon the orifice of the instrument.

## 13. FOREIGN BODIES.

The air-passages are liable to the intrusion of a great variety of substances, referable to four distinct classes, the vegetable, animal, mineral, and mixed, the latter comprising such as are partly vegetable and partly animal, partly animal and partly mineral, or partly mineral and partly vegetable. Of these different substances, those which most commonly enter the air-passages, at least in this country, are grains of corn, beans, melon-seeds, pebbles, and cherry-stones. Bits of meat, bone, and gristle, are also very frequent intruders. Pieces of coin, pins, buttons, and similar articles are extremely liable to be entrapped in the windpipe, in consequence, apparently, of the foolish habit, so common everywhere, of holding such substances heedlessly in the mouth. I have been made acquainted with quite a number of cases, one of which fell under my own observation, in which the foreign body was a cockle-bur (fig. 274). Substances of extraordinary size sometimes pass into the air-tubes. Thus, in a case of a child between three and four years of age, communicated to me by Dr. Zebra Foote, of Indiana, the foreign body, a brass pen-holder, was three inches and a half in length by three lines in diameter. It had descended

Fig. 275.

Fig. 274.



into the left bronchial tube, where it was found after death, nine months after the accident, surrounded by thick matter. Several cases have been reported of the accidental inhalation of ears of rye, wheat, barley and grass (fig. 275). Worms, especially the lumbricoid variety, have been known to creep into the windpipe; and at least one instance has occurred of death from the introduction of a leech into the sinus of the larynx. Gautier gives an instance of death from the inhalation of a small fish.

In my Treatise on Foreign Bodies in the Air-Passages, a number of cases are mentioned in which teeth, both natural and artificial, were inhaled. In several of the cases the artificial teeth were connected together by metal, as in fig. 276. In this instance, the substance was retained for thirteen years, and was found, on dissection, in the right thoracic cavity, into which it had passed by ulceration. Mr. Nunn has published the particulars of the case of a man, who drew a puff dart (fig. 277) into his windpipe. Occasionally the entrapped substance has been



a bullet, as in two instances reported to me by Dr. Maxwell, of Indiana, and by Dr. Stitt, of Kentucky.

Fig. 276.



Fig. 277.



Two, three, and even four foreign substances occasionally enter the air-tubes, either simultaneously or successively. Dr. Sipe, of Missouri, has communicated to me the particulars of the case of a child, who, the larynx being opened, ejected not less than a dozen fragments of parched corn. Dr. Mount, of Cincinnati, met with an instance, in an infant five weeks old, who, after the operation of laryngo-tracheotomy, expelled four pieces of unburnt coffee, three immediately, and the other and largest one the next day. Sometimes the substances are of a dissimilar character. Thus, in a case observed by Professor Van Buren, of New York, the child, upon the windpipe being opened, coughed up a water-melon seed and the shank of a plum.

*Situation.*—The foreign body may be arrested in different portions of the windpipe, or it may remain loose, and move up and down the canal during the expulsion and introduction of the air. Occasionally, it is stopped at the very entrance of the larynx; but more frequently, by far, it passes into the interior of this tube, and lodges in one of its ventricles. It is not often arrested in the *trachea*, or, if arrested there, it does not long remain in it. Instead of this, after having passed the larynx, it generally, either at once, or at a very early period, descends into one of the bronchial tubes, from which, however, during a violent expiratory effort, it may again be impelled upwards, not only into the trachea, but even into the larynx. A needle, pin, bit of bone, or, in short, any sharp and slender body, might be permanently retained in the trachea, in consequence of its extremities becoming implanted in its walls; so also might a cockle-bur, a piece of meat, a lump of cheese, or a piece of sponge. A solid or heavy body, as a bullet, pebble, shot, or grain of corn, will, on the contrary, be almost certain to pass at once into the bronchial tubes, in obedience simply to the laws of gravity.

When a foreign body passes into the bronchial tubes its tendency is to lodge in the right; a circumstance which has long been known, and variously explained. Thus it has been supposed to be owing to the differences in the capacity and direction of the two tubes, the right being larger than the left and placed more horizontally. The real cause, however, would seem to be the ridge, or spur, in the lower part of the trachea, the position of which, towards the left of the mesian plane, has the effect of throwing the foreign body, as it descends, over towards the right side, an effect still further favored by the greater diameter of the passage. Sometimes, each bronchial tube contains a

foreign body; and occasionally, again, although rarely, the substance is forced on beyond the primitive division into a secondary one.

The glottis, although by far the most common, is not the only avenue by which foreign bodies may reach the windpipe; occasionally they enter the tube from without, either by penetrating the skin and muscles of the neck, as in the remarkable instance observed by De La Martiniere, in which a little boy, in cracking a whip, forced a brass pin into the windpipe; or they may be pushed into the passage from the œsophagus in consequence of the attempts made to extract them from this canal, as in a case which occurred to Dr. Eve. Again, foreign bodies may enter the lungs through the walls of the chest, instead of passing into them by the more natural and common route of the glottis.

*Expansion.*—When the foreign body is of a vegetable or animal nature, it is liable to imbibe some of the moisture of the surface with which it lies in contact, and thus increase in volume. The heat of the part no doubt also contributes to this result. The degree of expansion which may be produced under the joint influence of these causes varies too much to admit of precise statement. Beans, peas, and grains of corn, seem to be particularly prone to increase in bulk; sometimes a great deal even in a very short time. Occasionally the substance exhibits signs of germination. On the other hand, there are certain bodies which are incapable of thus expanding, as melon, orange, pear, and similar seeds, beef, cartilage, tendon, apple, cabbage, turnip, and other vegetable matter.

It is probable that the particular situation of the foreign body has some influence upon the change of bulk and consistence wrought upon it during its sojourn in the windpipe. A substance impacted in one of the bronchial tubes would be likely, I think, to experience this change in a greater degree, as well as more rapidly, than one lodged in the trachea, or larynx. The extent of contact should also be taken into account; and, finally, the character and quantity of the secretion excited by the presence of the extraneous body.

When the foreign body is long retained, it not unfrequently becomes incrustated with various kinds of matter, especially if it be lodged in one of the bronchial tubes. The investing matter may be merely inspissated mucus, or it may consist partly of mucus and partly of lymph, of lymph alone, or of earthy substance, principally carbonate and phosphate of lime, cemented by a little animal matter.

*Pathological Effects.*—The foreign substance may produce various changes in the structures with which it lies in contact, as well as in those in its neighborhood. Occasionally, though rarely, remote parts, as the lungs, trachea, and larynx, become affected, either primarily or secondarily, in consequence of the irritation thus induced.

One of the most common of these effects is inflammation of the mucous membrane, generally, however, of limited extent. When the foreign body is bulky, and creates great inconvenience, or is retained for a long time, the morbid action becomes diffused, often spreading a considerable distance beyond the part originally affected, and leading to deposits of lymph, if not also to softening. In chronic cases, the mucous membrane is liable to become thickened, indurated, and deeply

congested. Ulceration is uncommon. Sometimes, though rarely, the foreign substance is partially surrounded by lymph, which thus retains it in its situation.

When the extraneous substance is retained in the bronchial tubes, serious disease is liable to occur in the lungs, especially inflammation, which sometimes involves an entire lobe, if not the whole of the corresponding organ; sometimes, indeed, the mischief extends even to the other lung, or both viscera may suffer simultaneously. Occasionally abscesses form, and continue to discharge for an indefinite period; they generally occur at the seat of the obstruction, or in its immediate vicinity, but sometimes, though very rarely, they are found at remote points. Their contents are usually of an unhealthy character, being more or less fetid, tinged with blood, and intermixed with mucus. The pulmonary tissues around them are usually densely hepatized, and deeply discolored.

Sometimes, again, the foreign substance, especially when retained for any length of time, induces a deposit of tubercular matter in the tissues immediately adjoining it. Pulmonary emphysema is another effect, but also a very rare one, and the same remark is true of cedema of the larynx.

The bronchial lymphatic ganglions are also liable to suffer. The most common alterations are enlargement, preternatural vascularity, and softening of their substance. The occurrence of suppuration is infrequent. The morbid action sometimes extends to the pleura, leading to effusion of serum and lymph, and also, occasionally, to the formation of pus. Extensive adhesions have been known to form, as a result of the inflammation produced by the presence of the foreign substance between the opposite sides of the pleura; and now and then thick layers of false membrane are seen.

It is a singular fact that these pathological changes may all occur, to a greater or less extent, in cases where the obstruction is exclusively seated in the larynx or the upper portion of the trachea.

In a few instances the heart and pericardium have been found inflamed, but whether from an extension of the morbid action from the respiratory organs, or from embarrassment induced in the pulmonary and cardiac circulation, is a circumstance which cannot be determined.

When abscesses form after this accident, whether as a consequence of simple pneumonia or of the softening of tubercular deposits, the matter generally passes into the bronchial tubes, whence it is afterwards discharged by coughing or expectoration. Occasionally it points externally at one of the intercostal spaces, where it sometimes forms an opening, through which the foreign body ultimately escapes. Dr. John L. Atlee has communicated to me the particulars of a case in which he ruptured a large abscess in the lung in an attempt at extracting the foreign body. When the substance is long retained, it may excite ulceration of the bronchial tube, and finally drop into the pleuritic cavity, causing fatal inflammation.

*Symptoms.*—The symptoms which follow and accompany this accident may be divided into those which take place at the moment of



the introduction of the foreign body, and those which arise in consequence of its sojourn in the air-passages. This distinction, although recognized by most writers, has not, it seems to me, received the consideration to which its importance, practically speaking, entitles it.

The moment a foreign substance, however small, touches the wind-pipe, it excites severe distress and coughing, on account of the spasmodic action of the muscles of the larynx. We have a familiar illustration of this in the suffering which occurs when a drop of water, a crum of bread, or a particle of salt accidentally slips into the glottis. Instantly the most violent distress is excited, which generally continues until the intruder is dislodged from a situation which nature never intended it to occupy, and where it could not remain long without causing serious structural mischief. But these symptoms are, in general, slight and transient compared with those that attend the intromission of a foreign body, properly so called. In the latter case, the patient is usually in imminent danger of suffocation, and he may, indeed, regard himself as being very fortunate if he escapes with his life. In the great majority of instances, he is seized with a feeling of annihilation; he gasps for breath, looks wildly around him, coughs violently, and almost loses his consciousness. His countenance immediately becomes livid, the eyes protrude from their sockets, the body is contorted in every possible manner, and froth, and sometimes even blood, issue from the mouth and nose. Now and then he grasps his throat, and utters the most distressing cries. The heart's action is greatly disturbed, and not unfrequently the individual falls down in a state of insensibility. Sometimes a disposition to vomit, or actual vomiting, occurs immediately after the accident, especially if it take place soon after a full meal. The relief occasionally experienced from this source is very great. In some instances, again, there is an involuntary discharge of feces and even of urine. A considerable quantity of pure blood is occasionally thrown up during the violent coughing immediately consequent upon the accident.

The duration of the first paroxysm varies from a few seconds to several minutes, or, in severe cases, as when the foreign body is arrested in the larynx, even to several hours. With the restoration of the respiration, the features resume their natural appearance, and the patient recovers his consciousness and power of speech. The voice, however, frequently remains somewhat altered, the breathing is more or less embarrassed, and the individual is harassed with frequent fits of coughing, often attended with a recurrence of all, or nearly all, the original symptoms. Thus the case may progress for an indefinite period, until the foreign body is expelled, or until it produces death by disease of the air-passages.

Should the obstruction be kept up, even if it be only for a few days, the patient will be in twofold danger; for he will not only be liable to be suffocated at any moment by the foreign body passing up into the larynx, during a paroxysm of coughing, but the probability is that the lungs will resent its presence by taking on inflammation, which no skill, however well directed, can always effectually arrest.

Occasionally there is almost an entire absence of symptoms. The

foreign body seems to be in a state of latency, causing little or no inconvenience. Thus, in a case reported by Louis, the patient, after the first few minutes, did not experience any bad symptoms for an entire year. At the end of that time, he coughed up a cherry-stone, followed by such a copious expectoration as to cause death in three days.

The *cough* is usually spasmodic, sudden, short, and uncontrollable, lasting from a few seconds to half an hour or more. During its existence the patient frequently experiences a sense of tickling in the throat, with soreness and pain in the respiratory tubes and at the top of the sternum; the countenance is suffused and even livid; the brain is oppressed by sanguineous determination; and if the paroxysms be violent and protracted, there is sometimes a discharge of blood from the nose and mouth.

Sometimes the cough is of a croupous character. When this is the case, it may be very difficult to ascertain the true nature of the affection, or to determine whether the symptoms really depend upon disease of the larynx, or upon the existence of a foreign body.

The cough, after having existed for a short time, may disappear, and never recur. It is occasionally influenced by the patient's posture. Thus, he may be perfectly free while sitting up, or lying down, but the moment he rises, or moves his body, he may be seized with a violent paroxysm.

The *voice* is variously affected. Generally it is natural, or so nearly so as to render it difficult, if not impossible, to detect the change. Occasionally, however, it is remarkably altered, both as it respects its quality and strength. Sometimes it is croupy, hoarse and low, sharp and sibilant, or as if it were cracked. Now and then it is reduced to a mere whisper, or entirely extinct. These alterations may occur immediately after the accident, or they may not appear until the foreign body has had time to cause irritation in the vocal cords. Sometimes the power of speech is temporarily lost, and then returns, either suddenly or gradually, without any assignable cause.

The *expectoration* is ordinarily of a thin, sero-mucous appearance, and varies in quantity from a few drachms to several ounces in the twenty-four hours, according to the frequency and violence of the cough. Not unfrequently it is very thick and ropy, more or less opaque, and remarkably abundant. Occasionally it is of a dirty, rust-colored aspect, or tinged with blood. When cavities form around the foreign body, whether in consequence of gangrene, or the softening of tubercular matter, the expectoration may be almost insupportably offensive.

Sometimes the patient throws up *blood*, either pure or mixed with frothy matter. The quantity is usually very small, not exceeding a few drachms. The accident may occur immediately after the introduction of the foreign substance, or it may not take place until serious structural changes have taken place in the lungs.

The *pain* which follows this accident is subject to much diversity, depending upon various circumstances. Generally it is very slight, at all events until the resulting inflammation has produced serious

structural lesion. In its character, it may be sharp and pricking, or dull, heavy, and aching; it may be limited to the seat of the foreign body, or it may pervade the trachea, larynx, bronchial tubes, and lungs, if not also the throat, œsophagus, and muscles of the chest. It is generally accompanied with a sense of constriction, tightness, or suffocation, and is liable to be aggravated whenever the patient coughs, or whenever there is the slightest change in the situation of the foreign body. It may also be stated, as a general rule, that the pain will be greater when the foreign substance is large and rough than when it is small and smooth. The pain occasionally remains fixed for a long time at one spot, and then suddenly shifts to another. It appears to be most apt to become fixed when the foreign body is impacted, or immovable. Sometimes the pain remains at its original site long after the extrusion of the foreign substance.

Instead of pain, the patient occasionally experiences a feeling of *soreness*. This may occur at various points of the respiratory apparatus, and is, perhaps, more frequently present than the practitioner is aware, owing to the want of a thorough examination, or the fact that the patient is not always able to indicate the nature of his suffering.

No substance can remain for any length of time in the air-passages without causing more or less serious disturbance in the *respiratory functions*. The patient has hardly escaped from the immediate effects of the accident before his life is endangered by inflammation, which, if not promptly subdued, may speedily prove fatal. This effect, which is always to be dreaded in every case of the kind, devolves upon the attendant the absolute necessity of frequent examinations of the chest, both by auscultation and percussion.

One of the most remarkable circumstances after this accident, is that, while the patient can freely inspire, he often finds it almost impossible to expire. This is particularly the case when the foreign body lies in one of the bronchial tubes, which may be thus almost completely closed, neither allowing the air to enter nor to pass out of it. Nevertheless, as the other canal remains free, inspiration may be carried on with considerable vigor, whereas every attempt to expel the air from the obstructed lung will be attended with great suffering and a feeling of exhaustion. If, under such circumstances, the ear be applied to the chest, the respiratory murmur on the affected side will be found to be either entirely inaudible, or but faintly appreciable, while on the sound side it will either be perfectly natural, or more or less puerile, if not characterized by various râles. Whenever this happens, the thorax will be found everywhere perfectly clear, on percussion; the reverse being, of course, the case when there is hepatization from disease, or excessive engorgement of the pulmonary tissues, as will necessarily occur in nearly every instance, within a short time after the foreign body has reached the air-passages. Occasionally, the air, as it rushes by the foreign body, produces sounds so peculiar that they may be regarded as pathognomonic of the nature of the affection. Thus, in a case observed by Mr. McNamara, of Dublin, the noise resembled that produced by blowing through a whistle, the foreign



substance being a plum-stone, perforated at the middle. Occasionally the substance, as it plays up and down the windpipe, produces a peculiar flapping sound. Now and then the symptoms are of an asthmatic character.

The *posture* of the patient varies. Generally he finds it most agreeable to sit up; for as soon as he attempts to lie down he is seized with an increase of embarrassment of breathing, with a disposition to cough and a feeling of suffocation. During sleep he is consequently obliged to be propped up in bed, or to get what rest he may be able to obtain in a chair. Sometimes, however, he lies best on his back, or on one side.

The *general health* is variously affected; sometimes slightly, sometimes severely, sometimes, again, not at all. In most cases, however, even in those in which the foreign substance is not retained beyond a few days, the system is feverish, and the patient suffers from want of appetite and sleep, attended with an anxious expression of the features. If the irritation continues, inflammation of the lungs and air-tubes soon takes place, with an aggravation of the cough, emaciation, and loss of strength.

*Diagnosis.*—As these accidents occur most frequently in infants and children, who can but ill express their feelings, one of the first duties of the practitioner is to inquire, most carefully and circumstantially, into the history of every case that may be brought under his observation. Very frequently some time elapses before he can reach the patient, or it may be that, although the interval between the occurrence and his visit may be very short, the first symptoms may have entirely disappeared, and the patient act and feel as if nothing had taken place. Now, it is just in such cases as these that errors are most liable to happen; for the reason that the professional attendant, seeing that there is apparently nothing the matter, allows his mind to be lulled into a state of security, frequently not less injurious to himself than destructive to his patient. It is generally different with adults, who are usually conscious of the time and manner of such accidents, and who, therefore, rarely fail to give a correct account of them.

If the patient, supposing him to be a child, has been playing with a grain of corn, bean, pebble, or similar body, and has been suddenly seized with symptoms of suffocation, violent spasmodic cough, lividity of the face, pain in the upper part of the windpipe, and partial insensibility, the presumption will be strong that the substance, whatever it may have been, has slipped into the air-passages, and is the immediate and only cause of the suffering which the surgeon has been sent for to relieve. The presumption will be converted almost into positive certainty if the person was just previously in the enjoyment of good health; if he was romping, jumping, or laughing at the moment of the accident, with the substance, perhaps, in his mouth, or while attempting to throw it into that cavity; and especially, if the symptoms, after having been interrupted for a few minutes, continue to recur, with their former, or even with increased, intensity, at longer or shorter intervals. The symptoms here enumerated, however, are

sometimes, it must be confessed, most painfully simulated by the cough and embarrassment of breathing occasioned by cold and other affections. The difficulty in arriving at a correct diagnosis is still further augmented, in some of these cases, by the coincidence of the respiratory trouble and the fact of the child, at the moment of the seizure, having been engaged in playing with a substance such as that above mentioned.

Important information may frequently be obtained, in these accidents, by a careful exploration of the chest by means of *auscultation* and *percussion*. This is particularly the case when the foreign body is situated in the lower extremity of the trachea, or in one of the bronchial tubes, where, especially if it be bulky, or pretty firmly impacted, it must necessarily affect, more or less seriously, the respiratory functions, and thus manifest itself by the alterations which it induces in the sounds of the lungs and chest. These alterations are always less distinct, and, indeed, not unfrequently entirely absent, when the extraneous substance occupies the larynx, or the upper portion of the trachea.

A stethoscopic examination, however, although generally useful, and, therefore, never to be omitted, does not always afford satisfactory evidence of the nature of the case. Of the truth of this fact my observation has furnished me with several instances, in none of which, notwithstanding the most careful and repeated exploration, I could determine the situation of the intruder.

Two circumstances may be mentioned as likely to occasion this result. In the first place the auscultatory signs may be masked by previous disease, or by disease awakened soon after the occurrence of the accident, as inflammation of the windpipe, lungs, or pleura; and in the second place, the patient, especially if a child, may offer such resistance, either by his movements or cries, as absolutely to prevent the possibility of a thorough exploration. It is a question which has not yet been solved by experience, whether, in the latter case, the obstacle could not be promptly and effectually surmounted by the use of chloroform. It would certainly have the effect of rendering the patient perfectly passive, and would thus afford an opportunity of exploring the chest in the most satisfactory manner. We administer chloroform in sounding the bladder for stone, and why should we not employ anæsthetic agents when we wish to ascertain the existence of a foreign body in the air-passages? I throw out this hint as worthy of serious consideration.

Some inference, too, of a diagnostic character, may generally be drawn from the nature of the foreign substance. Ponderous bodies, such as bullets, shot, metallic buttons, pebbles, and pieces of coin, will generally at once descend into the bronchial tubes, from which they will afterwards be unable to rise in the act of coughing, sneezing, or any other violent expiratory effort, as bodies are liable to do when they are of an opposite description.

If the foreign body be large, and at the same time very rough, angular, or spiculated, it will probably be arrested in the larynx or the trachea. The same circumstance will be likely to occur if it be

long and narrow, as in the case of a needle, pin, nail, or fish-bone, unless it should happen to enter the glottis vertically, when it may at once fall into one of the bronchial tubes.

In some instances, as stated elsewhere, the foreign substance is capable of producing a peculiar noise, occasionally detectable even at a distance from the patient's body.

No definite information can, I think, be derived from the state of the *voice* when the foreign body lies in the trachea or in one of the bronchial tubes. Under such circumstances, it may be more or less changed; or, in rare cases, perhaps, even entirely absent; but as the alterations are not peculiar, but altogether similar to those produced in ordinary affections of the air-passages, it is evident that they are of no diagnostic value. The reverse, however, is the case when the foreign substance is retained within the larynx; for then the changes in the vocal functions, if not actually characteristic, may, in conjunction with other symptoms, afford most important, if not conclusive information.

The *pain* accompanying this accident cannot be regarded as diagnostic, inasmuch as it may be produced by other causes, as inflammation, neuralgia, or spasm of the air-passages.

The symptoms of extraneous bodies in the respiratory organs may be imitated by different diseases, either directly affecting these organs or acting upon them sympathetically. Of these diseases the most important are croup, whooping-cough, ulceration of the larynx and trachea, aneurism of the aorta, and worms in the intestines.

It is generally easy to distinguish between the symptoms of a foreign body and those of spasmodic *croup*, by observing that, in the latter affection, the chief difficulty of breathing exists during inspiration, while in the former it exists during expiration. Important information may also be derived from the state of the voice, which is usually characteristic in croup, and from the state of the pulse and skin, which are rarely excited until after the extraneous substance has had time to cause inflammation and sympathetic irritation, whereas they are usually more or less seriously disturbed at an early stage in laryngeal disease. Besides, in the latter affection, the symptoms are continued, whereas in the case of a foreign body in the air-passages, there are frequent intermissions, followed by sudden aggravations of suffering. Professor J. B. S. Jackson, of Boston, has communicated to me the particulars of two cases, in which the symptoms produced by foreign bodies in the air-passages, were mistaken for those of membranous croup.

Alarming symptoms, simulating those of a foreign body in the air-passages, may arise during an attack of *whooping-cough*. Here mistake may be prevented, first, by a careful consideration of the history of the case; secondly, by the existence of the peculiar hoop, which is always wanting in the latter affection; and, lastly, by the fact that the embarrassment of breathing occurs in this disease, as in croup, not during expiration, but during inspiration.

*Spasm of the glottis*, by producing suffocation, may give rise to symptoms simulating those of a foreign body in the windpipe. A common cause of this is ulceration of the larynx. Should such an occurrence take place while the patient is eating, it would be very natu-



ral to ascribe it to the presence of a foreign body in the air-passages, although these passages might be entirely free from mechanical obstruction. The diagnosis, in such an event, would, of course, be extremely difficult, if not impossible. The history of the case might furnish some clue, though hardly any of a satisfactory character. Upon whatever cause the symptoms depend, tracheotomy alone would be likely to save the patient, and it should, therefore, be performed without delay.

Similar embarrassment may arise from an *aneurism* of the thoracic aorta. The pressure of such a tumor may, as is well known, produce great narrowing both of the trachea and of the bronchial tubes, particularly the latter, thereby seriously impeding the passage of the air to the lungs. The diagnostic signs, in cases of doubt, are the gradual approach and persistent character of the symptoms in aneurism, and their sudden, violent, and intermittent character when occasioned by the presence of an extraneous substance. Moreover, it is worthy of remembrance, that such accidents are most frequent in children, while aneurism of the thoracic aorta is almost exclusively confined to elderly subjects.

The sympathetic irritation induced by *worms* in the alimentary canal, may closely simulate the phenomena produced by the presence of a foreign substance in the windpipe. The most certain diagnostics, in circumstances of doubt, are the history of the case, and the prompt relief which usually follows the exhibition of anthelmintic remedies, when the affection is of a verminous character; and the failure of these means, when the symptoms depend upon the presence of a foreign body.

Symptoms, closely resembling those produced by foreign bodies in the air-tubes, may be caused by the lodgment and impaction of extraneous substances in the *pharynx* and *oesophagus*. This fact shows the importance of thoroughly examining, in all cases of doubt, the latter passages with the finger and probang before we attempt an operation for the relief of the patient, or before we rest satisfied that the obstruction is really in the windpipe. From the want of such precaution serious consequences might arise.

Finally, it is well known that if a foreign body, such, for instance, as a piece of meat, or cartilage, is retained even for a short time in the *oesophagus* or *fauces*, the irritation occasioned by its presence will often remain for hours, if not days, after its removal. Such is the distress sometimes, under these circumstances, that it is very difficult to persuade the patient that the substance is not still in its original situation. As the same thing may occur when the foreign body is in the windpipe, the practitioner, unless fully on his guard, may be led into most serious error. Indeed, there is reason to believe that bronchotomy has occasionally been performed under such circumstances.

It is not always easy to determine, from a consideration of the history and symptoms of the accident, whether the offending substance is in the larynx, or in some other portion of the windpipe. Our knowledge upon the subject, indeed, is far from being satisfactory.

From an analysis of sixteen cases of foreign bodies in the *larynx*, I

am led to conclude, that, as a general rule, whenever there is aphonia, whether partial or complete, the substance is situated in this portion of the windpipe; at all events, there is a strong probability that this is the case, a probability which is converted into perfect certainty, if, conjoined with this symptom, there is pain, soreness, or uneasiness in the region of the larynx, along with dyspnœa, a whistling sound in respiration, absence of serious disease in the bronchial tubes and lungs, and inability, on the part of the observer, to perceive the offending body moving up and down the trachea. It is important, however, in reference to this subject, to bear in mind that the voice may be seriously affected, and yet the foreign body not be lodged in the larynx, but in the trachea, or in one of the bronchial tubes.

When a foreign body descends into one of the *bronchial tubes*, the respiratory murmur in the corresponding lung is generally more or less affected. The wall of the chest, however, is not always, perhaps not even generally, dull or flat, as in pneumonia and phthisis, in which the parenchymatous substance of the organ is condensed by abnormal deposits; on the contrary, the sound is frequently unnaturally clear and resonant, very much, indeed, as in pulmonary emphysema. This peculiarity is sometimes recognized over the entire lung; while at other times it is limited to particular portions, as one-half, a third, or one-fourth, according to the size and situation of the foreign body. When the extraneous substance is so large as to obstruct the bronchial tube completely, there must necessarily be marked dulness on percussion, and great diminution, if not entire absence, of motion in the ribs.

The *respiratory murmur*, under the same circumstances, may be very much diminished, or wholly absent, according to the amount of the pulmonary obstruction. In most instances it is lessened only somewhat in intensity, because a certain quantity of air still enters the lung by the side of the foreign body. It is only when the extraneous substance is very bulky, or when the tube is completely closed by it, or partly by it, and partly by abnormal deposits, as mucus or lymph, that the respiratory murmur can be no longer recognized, or only in the most imperfect manner.

It has already been seen that the extraneous substance may change its place in consequence of the impulse which it receives during coughing, during violent expulsive efforts of the lungs, or even during the various movements of the body. Thus, in one of my cases, the foreign body, a grain of corn, was impacted for upwards of a week in the right bronchial tube, when, all of a sudden, during a severe paroxysm of coughing, it passed over into the left, where it was discovered on the dissection. Its former presence on the right side was denoted not only by the alterations in the respiratory murmur and the extraordinary resonance on percussion, but by the peculiar pathological appearance of the mucous membrane in the right bronchial tube. It should also be recollected that the changes in the respiration may be materially influenced, if not entirely masked, by the deposits produced by the irritation of the foreign substance; thus frequently divesting them of their diagnostic value.

The foreign body occasionally plays up and down the trachea, either

in consonance with the respiratory movements, or in consequence of severe fits of coughing. During these changes, it is very apt to cause severe spasm and irritation by impinging against the mucous membrane of the larynx, sufficient, in some instances, to induce suffocation. In many of these cases the patient is rendered conscious of this occurrence, not only by the pain and spasmodic cough, but by the peculiar sensation which the substance produces as it passes up and down the windpipe. Sometimes, again, the extraneous body can be distinctly felt and even heard during these movements, as happened in an interesting case observed by Professor May. The patient was a child five years old; and the substance, a grain of corn, could be distinctly heard and felt at every expiration as it struck the upper part of the trachea.

Occasionally, the *noise* produced by the foreign body, or, more properly speaking, by the air as it rushes past it, is so peculiar that it may be regarded as pathognomonic of the nature of the accident. Sometimes the sound is of a whistling nature; at other times, it resembles a cooing rhonchus; and now and then it is a peculiar, flapping noise.

The preceding facts will, I think, generally enable us to determine whether the foreign substance is firmly impacted in one of the bronchial tubes, or whether it is liable to move up and down the trachea during coughing and respiration. It may be assumed, as a general rule, that the substance, whatever may be its character, remains loose. This is often true in cases even of long standing, but it is particularly so of recent ones, before the occurrence of much secretion, tending to attach the foreign body or impair its mobility, and before the development of serious structural lesion, as, for example, the formation of an abscess, in which the body may become permanently imprisoned. When we add to the above facts the absence of all laryngeal disease, and the unaffected state of the voice, the conclusion will be inevitable that the intruder is lodged in one of the bronchial tubes, or alternately in one of these tubes and in the trachea.

I do not think it is possible to determine, from anything that has yet transpired, whether a foreign body is permanently arrested in the trachea. The number of such accidents is exceedingly limited, and the phenomena attending them have been studied with too little attention to justify us in deducing from them any special conclusions.

*Spontaneous Expulsion.*—Almost every possible variety of substance, capable of entering the windpipe, may be spontaneously expelled. In my Treatise on Foreign Bodies in the Air-Passages, I have given the particulars of numerous cases illustrative of the subject. Among the more ordinary substances may be mentioned cherry-stones, nuts and fragments of their shells, water-melon seeds, beans, grains of corn and of coffee, bits of bone, nails and tacks; among the more uncommon, teeth, pieces of coin, bullets, cockle-burs, and ears of grass and grain. Professor Hamilton has communicated to me the particulars of an instance in which a tin whistle was spontaneously ejected. Nunn, Colles and Heustis have, respectively, reported cases in which ridance was thus effected of a puff-dart, a pop-gun, and a piece of feather, nearly two inches in length.



The expulsion usually occurs in a paroxysm of coughing, and the effort is no doubt greatly facilitated by dependency of the head, as when it is hanging over the edge of the bed. In forty-nine cases, tabulated in the work above referred to, riddance was effected, in this manner, in thirty-seven; in one in sneezing; in one in dreaming; and in one in spontaneous vomiting; the mode of expulsion in the remainder not being mentioned. Two cases have been communicated to me of the spontaneous expulsion of bullets in the act of coughing. At least two cases, in which shot were similarly disposed of, are upon record. In all these instances the patient's head was at the moment in a state of dependency.

The time at which the expulsion occurs varies from a few hours to many years. In a case reported to me by Professor Flint, of Buffalo, nearly three years elapsed; and Dr. Wulkupf, of Kentucky, has communicated to me the particulars of one of upwards of eleven years. In general, it will be found that the patient recovers after riddance has been effected; but, now and then, he perishes from the injury sustained by the sojourn of the foreign substance, as inflammation of the lung, or of the lung and pleura. In the case mentioned by Lescure, in which the foreign body, a piece of bone, was expelled at the end of seventeen years, death occurred eighteen months after the event, in consequence of the disorganized condition of the pulmonary tissues. On the other hand, the lungs may be greatly disorganized by the foreign substance, and yet not cause death after riddance has been effected. In a case which came under my observation, many years ago, in a boy upwards of eleven years of age, gangrene of this organ, eventuating in the formation of a large cavity, occurred, followed by complete recovery.

The expulsion usually takes place by the glottis; but now and then an instance occurs in which the substance is discharged through the walls of the chest. In the former case, it generally escapes by the mouth; sometimes with a good deal of force, in a violent expiratory effort. In children, the substance is occasionally swallowed, thus creating a painful state of uncertainty in regard to its disposition, which is, perhaps, only relieved by finding it in the alvine evacuations.

*Treatment.*—The treatment of foreign bodies in the air-passages is medical and surgical; the former being intended to protect the patient from suffocation and disease of the respiratory organs, the latter to effect riddance of the intruder.

An individual who has a foreign body in his windpipe should be regarded as an invalid, unfit to leave his room, or to attend to business. The treatment, in the early stage of the complaint, should be limited to a general supervision of the patient's health; that is, his diet should be carefully regulated, the bowels should be moved from time to time with mild purgatives, and the utmost attention should be paid to the temperature of the apartment, which should be uniformly maintained at about 68° of Fahrenheit. The chest should be thoroughly examined at least once a day by auscultation and percussion, to ascertain the condition of the lungs and bronchial tubes. Cough should be subdued by mild expectorants, containing, if there be fre-

quent spasms, a suitable quantity of morphia. Should symptoms of pneumonia, bronchitis, or pleuro-pneumonia supervene, they must be promptly met by the ordinary remedies, particularly the lancet, active purgatives, and tartar-emetic, aided, if necessary, by leeches and blisters. By watching the patient in this way, the respiratory organs may be protected from mischief, and the extraneous substance be expelled spontaneously; or, should an operation become necessary, he will be in a much better condition to undergo it with impunity.

The expulsion of the foreign body does not always secure immunity from danger. The air-passages, irritated by its presence, may have taken on inflammation before its extrusion, or this action may be set up soon after; and in either case the danger to life may be very great. A knowledge of this fact is of great practical importance, and cannot be too strongly impressed upon the mind of the attendant in all cases of this character.

It would seem reasonable, at first sight, to suppose that *emetics* would be beneficial in expelling foreign bodies from the windpipe, but experience has shown that they are not only useless, but often dangerous, by impelling the intruder into the larynx, and thus causing violent spasm of the glottis. Besides, their employment may occasion the loss of valuable time. In forty-six cases, analyzed in my *Treatise on Foreign Bodies in the Air-Passages*, in which various emetic articles were exhibited, there was not one in which they were of any material service, while in quite a number they were positively injurious. Their employment should, therefore, be discountenanced.

*Sternutatories* of every description, mild and harsh, vegetable and mineral, have been employed, with a view of aiding the expulsion of the intruder, but, with the exception of the case related by Boyer, in which the nose was tickled with snuff, while the patient was partially asleep, no benefit has followed their use. It is possible that this class of remedies might occasionally be beneficial, if conjoined with the use of chloroform. The proper plan would be to make the patient inhale this fluid until he is nearly insensible, and to irritate the Schneiderian membrane with snuff or some other substance the moment he begins to regain his consciousness. Should sneezing ensue while he is in this condition, with the air-tubes in a state of perfect relaxation, it is easy to conceive that the foreign body might be ejected. Nature would be taken, as it were, by surprise, as she has sometimes been by a dream, as in the remarkable case which happened to Mr. Cock, of London.

A very interesting case, in which a piece of fish-bone was expelled from the windpipe, under the influence of the inhalation of iodine, occurred in 1832, in the practice of Mr. Day, of England.

*Inversion of the Body.*—This operation, as the name implies, consists in suspending the patient by the heels, or in securing his body, with the head inclined downwards, to a chair, narrow table, or other suitable object. While in this position, the chest and back are repeatedly and smartly struck with the hands, to aid, first, in dislodging the offending substance, and, next, in propelling it through the glottis, or, in case of bronchotomy, through the artificial opening in the neck.

With the same view, the thorax is sometimes suddenly and forcibly compressed, the patient having previously taken a full inspiration. The object of this manœuvre is to empty the lungs as rapidly and as completely as possible, in order that the air, as it rushes through the windpipe, may carry the intruder before it. The compression is usually effected with the hands, applied at opposite points of the trunk; but, perhaps, a better method is to make it with a broad bandage, arranged so as to encircle the chest, and slit at the ends, after the fashion of the bandage used in tapping the abdomen. The patient having taken a full inspiration, the extremities of the bandage are suddenly drawn in opposite directions, thereby compressing the thoracic walls equably and forcibly at every point.

The great objection to this operation is the risk which the patient incurs from suffocation, occasioned by spasm of the glottis, from the contact of the extraneous body in its attempt to pass through the larynx. The only way of preventing this is either to administer chloroform, or, what is preferable, to open the windpipe as a preliminary measure. By this procedure, all danger of producing spasm of the glottis will be removed, and the foreign body will have a chance of escaping either through the larynx, or at the wound in the neck. Without this precaution, inversion of the body, unless practised with the greatest possible care, may be attended with very serious, if not fatal, consequences.

In the interesting case of Mr. Brunel, recorded by Sir B. C. Brodie, inversion invariably produced the most distressing coughing, with symptoms of impending suffocation, compelling the experimenter at once to desist. The object was, by permitting the patient's head and shoulders to hang over a chair, while the body was in the prone position, to afford the extraneous substance, a half-sovereign, an opportunity of slipping through the rima of the glottis into the mouth. During every effort of this kind, there was a distinct perception of a loose substance passing forward along the trachea, and striking against the larynx. Tracheotomy was afterwards performed, and an attempt made, but in vain, to extract the coin with the forceps. Finally, at the expiration of the sixteenth day after the operation, the patient's body and shoulders were secured to a peculiar contrivance, a sort of platform, made movable on a hinge in the centre, and so arranged as to permit the head to be brought to an angle of about  $80^{\circ}$  with the horizon. The back being now struck with the hand, severe coughing ensued, followed almost immediately by the ejection of the intruder.

*Operative Interference.*—Convinced that no person with a foreign body in the air-passages is a moment free from the danger of suffocation, I am very decidedly of opinion that no time should be lost in opening the windpipe. I am acquainted with the history of quite a number of cases in which life was destroyed by waiting in the vain hope that spontaneous expulsion might occur, and thus obviate the necessity of surgical interference. A violent cough coming on, the patient may drop down in a fit of unconsciousness, from spasm of the glottis, and be choked to death in an instant. Now, although the operation may not be immediately followed by the escape of the foreign



body, yet it will at least effectually prevent spasm of the glottis, and thus afford the extraneous substance an opportunity of being extruded either by the natural or artificial route. The patient has thus two chances of coughing it up, whereas before he had hardly one, the contraction of the muscles of the larynx constantly acting as a barrier to its escape. Even when the wound finally closes, without the foreign body being expelled, the operation may have been of the greatest possible benefit in preventing suffocation.

The operation which is usually performed is tracheotomy, as it affords much easier access to the foreign body than laryngotomy, as well as a much better chance for its spontaneous expulsion. The latter operation, however, should always be selected when it is certain that the substance is impacted in one of the ventricles of Morgagni, unless the patient is a child, with a very short, thick neck, rendering it difficult to obtain a sufficiency of room for the easy introduction of instruments. The incision in the trachea may occasionally be advantageously prolonged into the larynx, and conversely. In laryngotomy it is sometimes extended upwards through the greater portion of the thyroid cartilage. The manner of executing these operations, for this and other purposes, will be described under a distinct head. Meanwhile, it may be observed that, when it is performed for the removal of foreign bodies, the patient should always take chloroform or ether, and that the whole procedure should be conducted in the most careful and deliberate manner.

The moment the operation is completed, the patient is turned upon his abdomen, with the face towards the floor. The object of this procedure is to relax the edges of the wound, so as to afford a freer passage for the escape of the foreign body, and also for the discharge of any blood that may have accidentally entered the windpipe.

If the substance is not speedily ejected, the best plan will be to invert the patient's body, and to strike the chest with the hand, or with a pillow. This procedure should be tried in all cases of balls, shot, peas, beans, water-melon seeds, plum-stones, cherry-stones, button-moulds, and other similar articles. Inversion of the body, with previous opening of the tube, is a comparatively safe operation. Succussion and percussion are important auxiliaries in such a case.

If these measures fail, search should be made for the substance with the forceps, or hook, with a view to its extraction; but all such attempts should be conducted in the most gentle manner, nor should they be prolonged beyond a few seconds at a time; inasmuch as they almost invariably excite violent coughing and suffocative feelings. The use of chloroform, and the bending of the head will greatly facilitate this step of the procedure.

The foreign body, both in laryngotomy and tracheotomy, may escape either at the artificial opening, or by the glottis. In either case, it may be thrown to a considerable distance, perhaps the very moment the tube is pierced; or it may be intercepted by the edges of the wound; or it may, if it take the natural route, lodge in the mouth, or pass into the stomach.

Great care is taken not to permit any blood to enter at the artificial

opening, as the smallest quantity may not only induce violent cough and spasm, but instant suffocation. Should the accident be unavoidable, the patient must immediately be turned upon his abdomen, and, if necessary, the blood must be sucked out of the tube with the mouth. It is worthy of remark that the thyroid veins, which are generally so much distended in consequence of the difficulty of breathing and the struggles of the patient, often cease to bleed the moment the windpipe is opened and the air is freely admitted into the lungs.

When the extraneous body refuses to escape, or resists our efforts at removal, the edges of the tracheal wound should be kept apart by means of blunt hooks, in order to favor extrusion. No canula should ever be inserted, as it would seriously interfere with the expulsion of the extraneous substance. The outer wound should be covered, in this case, with a piece of gauze, arranged in the form of a bag, to prevent the ingress of flies and dirt.

Riddance having been effected, the wound is closed with adhesive strips, aided, if necessary, by a few interrupted sutures, care being taken not to carry them through the substance of the trachea. Simple water-dressing is the best application, but even this may, in general, be omitted.

The after-treatment must be strictly antiphlogistic; the respiratory organs must be diligently watched; and the air of the patient's apartment must be maintained, throughout, at a uniform temperature of about 75° of Fahrenheit. It should be remembered that no patient is safe, or out of danger, after this accident, so long as there is inflammation of the respiratory organs, whether the intruder has been expelled or not.

Bronchotomy does not always insure the speedy ejection of the offending body; on the contrary, we not unfrequently see cases where the only apparent good from the operation is relief from spasm of the glottis, the extraneous substance being, perhaps, permanently retained, or, at any rate, not ejected until some time afterwards, perhaps, indeed, not until the wound is entirely cicatrized, as happened in one of my own patients. Hence it may become necessary to repeat the operation a second, and even a third time.

*Instruments.*—Various instruments have been contrived for the purpose of effecting the dislodgment and removal of foreign bodies. Of these, a few of the most eligible and important require particular notice.

1. Figure 278 represents a pair of forceps, constructed for me by Mr. Kolbé, after a model of my own. They are composed of German

Fig. 278.



silver, and are a little upwards of eight inches in length. The handle is considerably curved on the flat, and has two large rings for the

thumb and finger. The blades, which are rounded and very slender, are five inches long, and terminate each in a fenestrated extremity, nine lines in length by three lines in width, the outer surface being smooth and convex, the inner flat and slightly serrated. The great advantages of this instrument are, first, that it may be used with equal facility as a probe and an extractor; secondly, that it may be bent at any point and in any direction, according to the pleasure of the operator; and thirdly, that it cannot possibly seriously impede the passage of the air, during the attempts which are necessary to explore the windpipe for ascertaining the precise situation of the foreign substance.

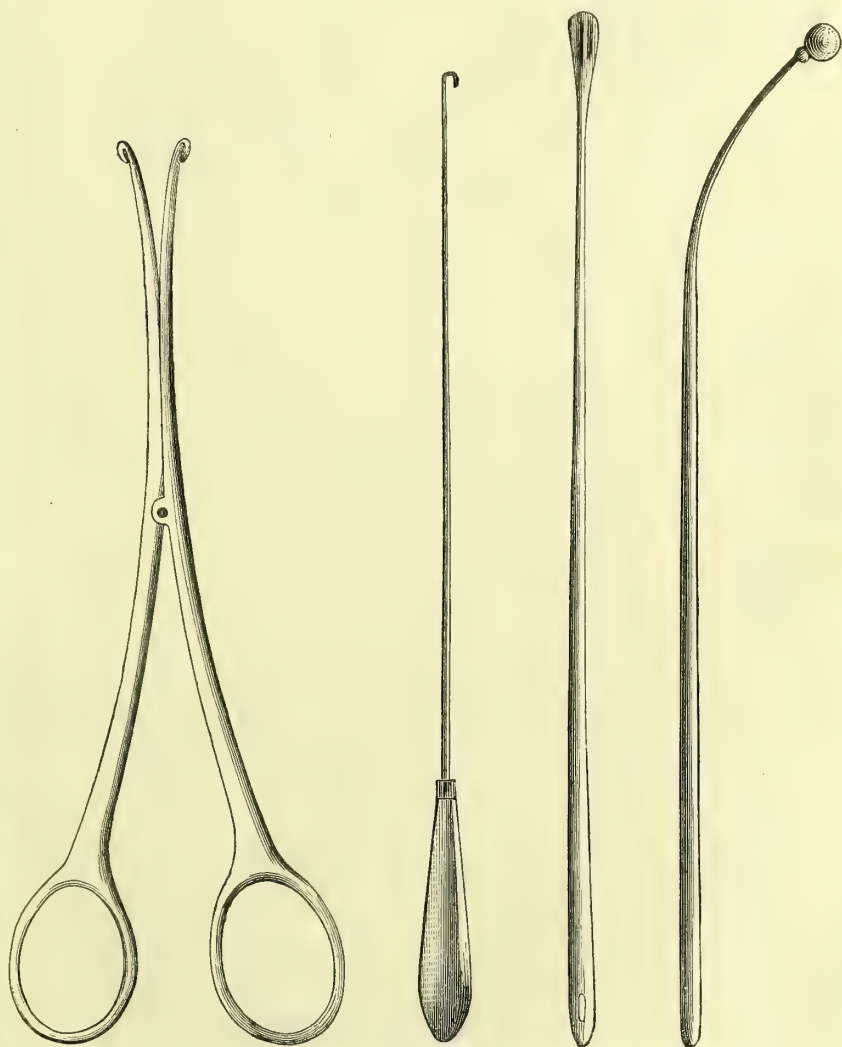
2. The forceps represented in the adjoining sketch (fig. 279), are intended for holding apart the edges of the wound in the trachea,

Fig. 279.

Fig. 280.

Fig. 281.

Fig. 282.





while the surgeon attempts to extract the foreign substance with other and more suitable instruments, introduced between their expanded blades. I have repeatedly found them very serviceable.

3. Figure 280 represents a long slender hook, composed of silver, and well adapted for extracting foreign bodies, as beans, grains of corn, coins, prune-stones, pebbles, and bits of bone, situated in the inferior portion of the trachea, or in one of the bronchial tubes. The curved part of the instrument is very short and blunt at the extremity.

4. For exploring the air-passages, or dislodging foreign bodies from the larynx, especially the ventricles of Morgagni, hardly anything better could be imagined than the probe sketched in fig. 281. It is about nine inches in length, bulbous at the extremity, and composed of silver. Being flexible, any curve may be imparted to it that may be desirable.

5. The instrument delineated by fig. 282 is merely a whalebone probang, bent at an angle of about forty-five degrees, and surmounted at its extremity by a small piece of very soft sponge. It is admirably adapted for removing extraneous matter from the larynx, and should find a place in every surgeon's drawer.

6. Another instrument which the operator should have at hand, especially when the extraneous body is impacted in one of the ventricles of the larynx, is a flexible, grooved director, such as is usually found in the common pocket case. The scoop-shaped extremity may be used with great advantage under such circumstances, particularly if it be slightly bent.

*Difficulties.*—The difficulties experienced in these operations, especially in tracheotomy, arise chiefly from the imperfect manner in which the patient's head is held, extraordinary shortness and thickness of the neck, uncommon turgescence of the cervical vessels, or irregularity in their distribution, ossification of the rings of the trachea, enlargement of the thyroid gland, and, finally, the occurrence of hemorrhage. These difficulties may usually easily be avoided by proper care on the part of the operator and his assistants. The rule is never to cut anything that can possibly be spared, but to hold it out of the way. Should any vessels be accidentally opened, they must immediately be seized and ligated.

In laryngotomy, the only artery at all in danger of being wounded is a small branch of the superior thyroid, which traverses the crico-thyroid ligament, and which, in the adult, is about the size of a crow-quill. In tracheotomy, the bleeding may proceed from the tracheal *plexus of veins* (fig. 283), or from the *middle thyroid* artery (fig. 284), given off either by the innominate or the common carotid; in some instances it is double, one offset being derived from the former, and the other from the latter vessel. In a preparation in the possession of Dr. S. W. Gross, the middle thyroid arises from the left subclavian, about three-quarters of an inch in front of the thyroid axis.

Although the hemorrhage in tracheotomy is usually insignificant, yet it may occasionally be very profuse, if not fatal; only so, however, in the hands of an ignorant, timid, or inexperienced operator. I have heard of at least half a dozen cases in which the patient perished from

Fig. 283.

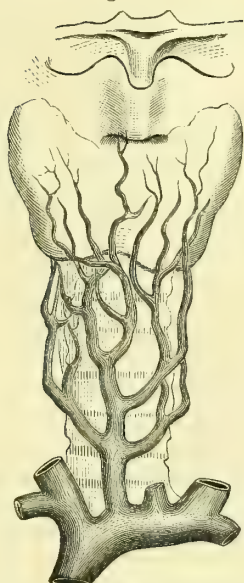
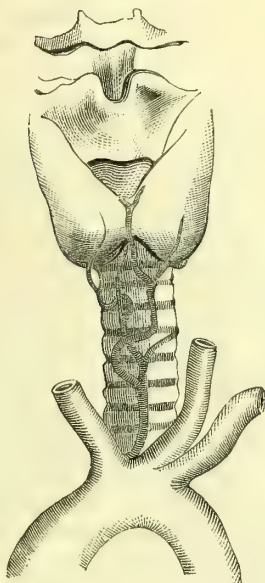


Fig. 284.



this cause. Occasionally quite a considerable flow of blood is occasioned by the division of the mucous membrane, especially when it is in a state of congestion, or inflammatory irritation, as it is apt to be when the foreign body has been retained for any length of time. Under such circumstances, the hemorrhage will, of course, be internal, and may proceed to such an extent as to cause the most serious impediment to the respiratory function. Whenever such an occurrence is threatened, the proper treatment consists in turning the patient as speedily as possible upon his face, in order that the fluid may escape at the artificial opening as fast as it is effused.

Finally, in opening the trachea, it should constantly be borne in mind that the innominate artery and vein may ascend unusually high up in the neck, or that they may cross this tube in such a manner as to incur the risk of being wounded by the incautious use of the knife.

*Contra-indications.*—Under no circumstances should bronchotomy be performed without a thorough exploration of the chest and œsophagus. It should be remembered that mere spasm of the glottis, caused by the lodgment of a foreign body in the fauces or gullet, or by derangement of the digestive, respiratory, and nervous systems, may induce a train of phenomena, closely resembling those occasioned by the presence of a foreign body in the air-tubes.

An important question here presents itself: At what period after the occurrence of an accident of this kind should an operation be considered as improper? Or, more correctly speaking, what are the circumstances which contra-indicate a resort to the knife? It must be obvious that the mere lapse of time should not be taken into the account in the decision of such a question; for it is well known that one individual may experience as much damage from the presence of

a foreign body in a week as another may in a month or a year. Thus, to particularize, the lungs may become seriously diseased, if not partially disorganized, in a few days, in one case, while in another they may suffer little, if, indeed, at all, during any stage of the accident. Hence it should be a rule with the practitioner, in every instance of the kind, to institute, as a preliminary step, a careful and thorough examination of the chest, with a view of ascertaining the precise condition of the respiratory apparatus. If this be found to be healthy, or even comparatively healthy, an operation, all other things being equal, would not only be justifiable, but highly proper, whatever length of time might have elapsed since the inhalation of the extraneous substance; if, on the other hand, it be seriously diseased, the knife should be studiously withheld, certainly temporarily, if not altogether, on the ground that the artificial opening would be very likely to complicate the morbid action, and thereby enhance the danger both to the part and to the system. I should certainly not consider it proper to operate upon an individual who, in consequence of having inhaled a foreign body, was laboring under violent pneumonia, a large abscess, or extensive tubercular deposits. To employ the knife, under such circumstances, could hardly fail to injure the patient and to throw discredit upon surgery.

*Mortality of Foreign Bodies.*—Some very interesting statistical facts have been furnished upon this subject by the collection of the recorded cases of foreign bodies in the air-passages, illustrative both of the nature of spontaneous expulsion, and of the effects of bronchotomy. In the work, already several times alluded to, I have recorded the particulars of 159 cases, in which spontaneous ejection took place in 57, 8 terminating fatally. Inversion of the body alone was successful in 5 cases, and unsuccessful in 6. Of 68 cases of tracheotomy, 8 died, and 60 recovered. Of 17 persons upon whom laryngotomy was performed, 13 lived, and 4 died. Laryngo-tracheotomy was practised in 13 cases; in 10 the operation was followed by recovery, and in 3 by death. Thus, of the 98 cases in which the windpipe was opened for the removal of foreign bodies, 83 were successful and 15 fatal, or in the ratio of about  $5\frac{1}{2}$  to 1.

Of the three operations performed upon the above cases, that of tracheotomy affords the most favorable results, the recoveries being in the proportion of  $8\frac{1}{2}$  to 1 death, whereas, in the other two, the mortality of each was twice as great. All these operations are, other things being equal, more successful the earlier they are performed, as there is then less disturbance in the respiratory organs.

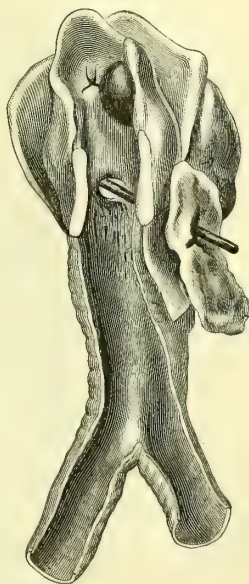
The causes of death after bronchotomy are various. The most common, undoubtedly, is inflammation of the lungs, which, as has already been seen, is liable to arise at various periods after the accident, and which often makes great, if not destructive, progress before the operation is performed. When death results from this cause, it may take place soon after the windpipe is opened; or, as is, perhaps, more generally the case, it may be postponed for a considerable time; until, in fact, the wound made in the operation shall have been completely cicatrized.



Death is sometimes occasioned by an inordinate deposition of mucus at the former seat of the foreign body, or in its immediate vicinity; it may also be produced by apoplexy of the brain, and by hemorrhage into the air-passages.

The adjoining sketch (fig. 285), for which I am indebted to Dr. Brinton, of this city, illustrates a very singular case of foreign body in the larynx, which I saw with that gentleman in October, 1856, in a boy, nine years old, who, on the evening of the 24th of September, had inhaled the shell of a chinkapin. The symptoms being urgent, tracheotomy was performed the next day, but no extraneous substance could be detected anywhere by means of the probe. Nearly three weeks after the accident, Dr. Brinton, satisfied that he had discovered the situation of the shell, enlarged the wound, which had been all along kept open with hooks, by dividing the cricoid cartilage and the crico-thyroid membrane. Again, however, nothing certainly was found, notwithstanding that a large probe was repeatedly pushed up into the fauces. The boy experienced some benefit from the operation, and was for awhile under the impression even that he had swallowed the intruder. He progressed favorably enough until the 5th of November, except that he had occasionally a spasmodic attack, which he was in the habit of relieving by holding the edges of the wound temporarily apart with a pair of curved forceps. At the time here alluded to, having a more violent paroxysm of dyspnoea than usual, he thrust the instrument forcibly through the posterior and lateral wall of the trachea, and, in the act of doing so, ruptured a small artery, the blood of which, descending into the trachea, caused instant suffocation.

Fig. 285.



The shell, on dissection, was found firmly embedded in the right ventricle of the larynx, a portion being hooked round the inferior vocal cord; it was three-quarters of an inch in length by four lines in width, was covered over with bands of lymph, and could not be detected by the probe carried upwards through the wound in the neck. An opening, the result, doubtless, of ulceration, existed in the posterior and lateral wall of the larynx, through which the boy had pushed the forceps so as to cause the fatal hemorrhage. The trachea was completely filled with blood.

#### 14. BRONCHOTOMY.

Under this denomination are included the three operations known, respectively, as laryngotomy, tracheotomy, and laryngo-tracheotomy. These operations may be rendered necessary by the following circumstances: 1. The presence of foreign bodies in the air-passages. 2.

Edema of the glottis. 3. Ulceration of the larynx. 4. Polypous growths. 5. Tonsillitis and retro-pharyngeal abscess. 6. Impacted matter in the œsophagus. 7. Suspended animation. 8. Carotid aneurism. 9. Membranous croup.

*Laryngotomy.*—Laryngotomy is a very simple and easy operation. The only structures that are divided are the skin, the cervical fascia, and the crico-thyroid membrane. If the patient is an adult, he may sit upon a chair, or, what is preferable, especially if he take chloroform, lie upon a narrow table, the head and shoulders being properly elevated and horizontalized by pillows. If, on the contrary, he is a child, he should be supported upon the lap of an assistant, and his body and limbs should be securely fastened with an apron, very much as in the operation for hare-lip. The head is thrown backwards and held by another assistant, in such a manner as to render the parts prominent and make the chin look directly forwards in the direction of the middle line. With a small, narrow scalpel, the surgeon, stationed in front of the patient, if he sits, or by his side if he is recumbent, makes an incision along the centre of the larynx, commencing at the top of the thyroid cartilage and terminating at the base of the cricoid. In the adult, the length of this incision will be fully one inch and a half, and hardly any less in a thick, short-necked child. It embraces the skin and cervical fascia, and usually also the crico-thyroid artery. Should this vessel bleed, it must either be forcibly twisted or secured with the ligature, lest the blood should find its way into the windpipe, and thus occasion severe cough, if not suffocation. All that now remains to be done is to divide the crico-thyroid membrane, in its whole extent, in the direction of the cutaneous wound. Should the opening not be sufficiently large, the incision may be prolonged into the contiguous cartilages, or a piece of the membrane may be cut away on each side of the wound. Some surgeons prefer making a crucial incision, and such a proceeding is quite proper when it is desirable to afford free play to the instruments without interfering with the thyroid and cricoid cartilages.

*Tracheotomy.*—If the operation of laryngotomy is simple and easy, it is far different with that of tracheotomy. This is particularly true with regard to tracheotomy in children with short, thick necks, to say nothing of the cries and struggles which they are sure to make if they are not under the influence of chloroform, or nearly choked by the foreign body. The use of anæsthetic agents, however, greatly facilitates the operation, and divests it of much of the dread which surgeons have always so justly entertained respecting it.

In performing tracheotomy (fig. 286), the same general rules are to be observed as in laryngotomy. An incision is made through the common integuments, directly along the middle line, extending from the base of the cricoid cartilage to within a quarter of an inch of the top of the sternum. The sterno-hyoid and sterno-thyroid muscles of the opposite sides are next separated from each other at their raphé, by a cautious use of the handle of the knife, aided, if necessary, by the point of the instrument, when the cervical fascia and the thyroid plexus of veins will be fully brought into view. The former is di-

vided in the same careful manner, while the latter is pushed aside, and protected by a blunt hook. If the middle thyroid artery is cut, which, however, is a rare contingency, it must instantly be secured. The isthmus of the thyroid gland, even when it descends considerably lower than usual, will seldom embarrass our progress; should it do so

Fig. 286.



it must be held out of the way, although it has sometimes been divided with impunity. Generally, however, it will be well to avoid it; should this be impracticable, any bleeding that may be apprehended can be effectually avoided by embracing the part in two ligatures, the knife being afterwards carried between them.

Satisfied that there is no blood at the bottom of the wound, the surgeon steadies the trachea with the left index finger, or, what is better, with a tenaculum, and divides at least three of its rings. In executing this step of the operation, the knife is entered at a right angle to the surface of the tube, with its back towards the sternum, care being taken to cut from below upwards, lest injury be inflicted upon the great vessels at the root of the neck. The incision in the trachea must strictly correspond with the centre of the external wound, and should be at least an inch in length. If shorter than this, it will scarcely suffice for the spontaneous ejection of the foreign body, or, when this does not happen, for the proper play of the forceps.

*Laryngo-tracheotomy.*—In performing laryngotomy, it not unfrequently happens that the opening afforded by the division of the crico-thyroid membrane is inadequate for the purpose for which it was made. In this event it may very readily be enlarged to the requisite extent, by dividing the cricoid cartilage and one or two of the upper



rings of the trachea. The operation, thus performed, has been denominated laryngo-tracheotomy, as denotive of the parts concerned in it. The chief objection to it is the danger of wounding the isthmus of the thyroid gland, and the branch of the superior thyroid artery, which so frequently courses along its upper border. When the foreign body is so firmly impacted in the larynx as to render it impossible to remove it by the ordinary operation, we may divide the thyroid cartilage in its whole length along the middle line.

## CHAPTER VIII.

## INJURIES AND DISEASES OF THE NECK.

## SECT. I.—WOUNDS.

ALTHOUGH wounds of the neck are treated upon the same general principles as wounds in the other parts of the body, yet they possess certain peculiarities which render it necessary that they should be noticed separately. Of these peculiarities the most important are hemorrhage, inflammation of the air-passages, emphysema, inanition, and the occurrence of fistule.

In regard to their character, wounds of the neck may be incised, contused, lacerated, punctured, and gunshot, precisely as in other regions of the body. In their extent, they vary from the merest scratch to almost complete severance of the neck, involving, of course, in the latter case, muscles, fasciæ, nerves, and vessels, along with the windpipe and œsophagus. The most frightful injuries of this description are generally inflicted in attempts at suicide, and yet, strange to say, these attempts are often entirely abortive, depending upon the fact that most persons, intent upon self-destruction, select the upper part of the neck, in the belief that suffocation will speedily ensue simply by opening the larynx. The consequence is that, although the gash may be a most horrible one, yet, the large vessels and nerves escaping, the patient not unfrequently makes a good recovery.

The sources of the hemorrhage in wounds of the neck vary according to the situation of the injury. When the knife is drawn deeply across the lower cervical region, the bleeding usually proceeds from the carotid artery and jugular vein; when the larynx is involved, the thyroid vessels generally furnish the blood, while high up, as when the lesion occupies the interval between the hyoid bone and the chin, the hemorrhage is derived from the lingual artery. It has been doubted whether the windpipe and œsophagus could be completely severed without injury of the carotid artery and jugular vein; but the possibility of the occurrence has been attested by several well authenticated cases.

The hemorrhage attending wounds of the neck may be almost instantaneously fatal, especially when it proceeds from the large vessels; or, the patient fainting, a temporary stop may be put to it until the surgeon has time to apply the ligature. Not unfrequently death is occasioned by the blood flowing into the air-passages, and so causing suffocation, even, perhaps, when no important artery has been laid open, or, if laid open, after it has been tied. Sometimes, again, the event is brought about by secondary hemorrhage, at the distance of a

number of days or several weeks from the receipt of the injury. The proper treatment of the bleeding is by ligation of the affected vessels. The jugular vein has been tied in numerous instances of cervical wounds, and I should certainly not hesitate to resort to this expedient if I found that the hemorrhage could not be effectually stopped by compression and other means. In most of the reported cases of the operation the result was most satisfactory.

Wounds of the *windpipe* are, in themselves, not particularly dangerous, but they nearly always become so, in consequence, as already stated, of the intromission of blood, thereby threatening suffocation, and of the remarkable susceptibility of the lungs, after such lesions, to inflammation. These, then, are the great sources of peril in cases of this description, and too much vigilance cannot be exercised to guard against their occurrence. When the tube is completely severed, the danger is, of course, imminent, death usually following in a short time from suffocation from the ingress of blood. Separation of the epiglottis is also generally fatal; if the detachment is partial, the flap may become entangled in the glottis; if complete, death will be likely to happen from inanition or inflammation. Larrey and others have mentioned cases in which the epiglottis was shot completely away, and yet the patients made a happy recovery.

The *treatment* of wounds of the windpipe should be conducted by suture, and position, aided by a strict surveillance over the lungs. I am aware that surgeons generally are averse to the use of the suture in lesions of this tube, but I cannot myself see any reason for sharing their fears in regard to its alleged injurious effects. It is the abuse, and not the proper use of the remedy that produces harm. In regard to injuries of the larynx and trachea, the operation is always perfectly safe, provided the surgeon does not effect approximation until all danger of internal bleeding has ceased. For this purpose he should wait from three to six hours, by which time all oozing will generally have stopped. Then with a fine needle and thread the edges of the wound should be carefully tacked together, by passing the instrument simply through the fibrous covering of the trachea, without, of course, including any portion of its rings. The stitches should be about three lines apart, and one end of the ligature should be cut off close to the knot. The external wound should afterwards be closed by sutures and adhesive strips. If any muscles are divided, their ends should be tacked together with the needle and thread. If the larynx be the part involved, the sutures are carried through the perichondrium, or even through the edges of the cartilages themselves. When the epiglottis is nearly severed, the best plan will be to cut off the flap, lest, falling into the glottis, it should cause suffocation. The dressing is completed by placing the head in an easy, comfortable position, with a slight inclination forwards, and confining it there by means of a tightly-fitting head-bandage, the extremities of which are secured to a broad roller encircling the upper part of the chest. Great care must be taken that the head is not drawn too far forwards, otherwise there will be danger of overlapping of the edges of the wound, both in the windpipe and in the soft parts.



The advantages of the suture in wounds of the windpipe are, first, a more rapid cure, and, consequently, less danger of hemorrhage and inflammation; secondly, greater facility of administering food and drink; and, lastly, much less risk of stricture and fistule of the tube. Should emphysema or internal bleeding occur after the parts have been approximated, it would be easy to open the wound, to a small extent in front, both in the integuments and in the windpipe, and even to introduce a canula, until all danger from these causes has subsided.

The *after-treatment* is strictly antiphlogistic. The tongue is frequently moistened with iced water; food and drink are, if necessary, conveyed into the stomach by means of a suitable tube, passed through the mouth; and the bowels are moved by enemata. Cough is allayed, and sleep induced, by morphia. The head and shoulders are elevated, and the dressings are disturbed as little as possible, the sutures being retained as long as they may seem to do good. Pulmonic and bronchial involvement are met by the usual means. Particular attention must be paid to the temperature of the patient's apartment; it should be regulated by the thermometer, and be constantly kept at 80° of Fahrenheit. The admission of cold air, especially through the wound, cannot fail to be pernicious, from its tendency to awaken cough and inflammation of the respiratory organs. The patient must be watched with the greatest possible care. If he be suicidally inclined, he must be put in the strait jacket, otherwise he will be sure to tear away the dressings, and open the wound, if he do not inflict other mischief.

Wounds of the *œsophagus* and *fauces* should always be treated upon the same principles as wounds of the intestines; that is, by sutures, placed from two to three lines apart, the needle being carried close down to the mucous membrane, and the ends of the ligature, drawn very tightly, cut off close to the knot, the thread eventually finding its way into the interior of the tube. The patient is supported by the stomach tube, introduced several times a day, and also, if necessary, by nutritive enemata.

Wounds of the cervical *nerves* are always objects of deep interest. Division of the phrenic nerves is necessarily instantaneously mortal, and the same is true of division of the pneumogastric nerves, although this has occasionally been denied. If only one of the pneumogastric nerves be severed, the patient may survive for some time, but will finally perish from the effects of congestion and inflammation of the lungs.

*Gunshot wounds* of the windpipe are generally mortal, although occasionally recovery takes place under circumstances apparently of the most desperate character. There is reason to believe that this tube possesses the faculty of deflecting bullets. In a case which I attended last winter with Dr. Hooper, of this city, a man was struck by a pistol ball directly over the middle line of the neck, about two inches above the sternum, and yet there was no symptom whatever denotive of perforation of the trachea, or of serious lesion of any kind.

*Laceration* of the trachea may be caused by external injury, as a blow or fall; or by a sudden and violent effort at inspiration after the integrity of the tube has been impaired by atrophy and ulceration, as happened in an instance reported to me by Dr. Thomas Marshall,

of Louisville. In either case, the immediate and necessary effect is emphysema of the neck and chest, if not also of other regions of the body, followed by excessive dyspnœa, and, if relief be not soon afforded, by death. The proper remedy consists in making numerous punctures, or, what is better, because more effectual, small incisions in different parts of the distended surface.

Wounds of the neck are sometimes followed by paralysis of the *superior extremity*, in consequence of violence inflicted upon the axillary plexus of nerves. Last winter, a young man was at the College Clinic, who had been struck in the neck with a long, narrow knife, the blade entering a little to the left of the median line, and passing behind the trachea and œsophagus, both of which, as well as the large cervical vessels, escaped injury. The right superior extremity became immediately palsied, succeeded by a sense of numbness in the thumb and first two fingers, rendering it thus highly probable that the weapon had wounded the median nerve, either close to its origin, or at the axillary plexus. The muscles soon began to waste, and when I saw the case, about six weeks after the accident, the whole limb was excessively atrophied and withered, purple, and icy cold. The deltoid was very tender on pressure, and severe pain extended along the arm as far as the ends of the fingers, which hardly admitted of the slightest motion. The general health had suffered a great deal, the countenance was very pallid, and there was great disorder of the digestive organs, with loss of sleep. Such lesions, unfortunately, are generally hopelessly irremediable. In the case here described, I was induced, as the man was poor, and endured great pain, to advise amputation at the shoulder-joint, if, in the course of a few months, there should not be marked evidence of returning power in the limb and subsidence of pain.

## SEC. II.—WRYNECK, OR TORTICOLLIS.

Wryneck, the torticollis of the old surgeons, consists in a permanent structural shortening of some of the cervical muscles, especially the

sterno-cleido-mastoid, twisting the head over to the corresponding side, while the chin projects proportionably in the opposite direction, as seen in the annexed drawing (fig. 287), from one of my clinical cases. The distortion thus produced is characteristic, causing a disagreeable, sinister, and constrained appearance, which nothing else can imitate. When existing in a high degree, the ear is approximated to the upper extremity of the sternum, the clavicle is elevated and deformed in consequence of the excessive tension of the sterno-cleido-mastoid muscle, and the chin

Fig. 287.



is thrown far beyond the middle line, almost into a horizontal position. The expression of the features is remarkably altered; the face on the affected side having a withered, atrophied appearance, the corner of the mouth being depressed, and the eye being much lower than the opposite one. The head is nearly immovably fixed, so that if the patient wishes to look at any object, he is obliged, unless it is directly in front of him, to turn his whole body; and there is generally, in the more aggravated cases, a peculiar lateral curvature of the neck, the concavity of which presents towards the side of the contracted muscles.

Wryneck occurs in both sexes, but my experience has afforded a larger number of cases in females than in males, and there is no doubt that the affection is generally considerably more frequent in the former than in the latter. The lesion is most common in children from three to ten years of age, and sometimes begins soon after birth. It has been said to be occasionally congenital, and cases of this description are no doubt now and then met with, but they must be extremely rare, none having ever fallen under my observation. The affection recognizes several distinct causes, of which the principal are inflammation, disease of the cervical vertebræ, and paralysis of the muscles. It may also be induced simply by a vicious position of the head, in consequence of the existence of an enlarged and painful condition of the lymphatic ganglions of the neck, compelling the patient to keep the cervical muscles in a constrained and rigid state. Any circumstance, in fact, that has a tendency to destroy the equilibrium of these muscles, and place them in an antagonistic state towards each other, may produce the distortion at any period of life, particularly in children during the rapid development of the body.

However induced, the affected muscles soon become permanently contracted and greatly indurated, as is rendered evident both to the touch and the knife. They feel like dense, rigid cords, which hold the head firmly in its unnatural position, and whose outline is easily traced along the neck. They are diminished not only in length, but also in breadth and thickness; their fibres, in cases of long standing, are converted into pale, fibrous filaments, united by unyielding cellular tissue, and hence, when an attempt is made to divide them, they offer an extraordinary degree of resistance, almost creaking under the knife. These circumstances, taken in connection, afford indisputable evidence that, whatever the exciting cause of wryneck may be, the muscles concerned in its production become the seat of inflammation and plastic effusion, probably at an early period after they have lost their equilibrium, unfitting them for the resumption of their functions without the division of their fibres.

The number of muscles affected in wryneck varies in different cases. Although the sterno-cleido-mastoid always suffers more than any other, yet it is by no means the only one which is concerned in producing and maintaining the distortion. The platysma, trapezius, scalene, splenius, and even the elevator of the scapula, not unfrequently participate in the disorder. It has been found that the sternal portion of the mastoid always suffers first, but I have never seen a case of con-



firmed wryneck where the clavicular division was not also implicated, and generally in a very marked degree.

The *prognosis* of wryneck depends upon circumstances. In the more simple forms of the affection, caused solely by muscular contraction, a cure may generally be certainly calculated upon, especially when the case is comparatively recent. When, on the other hand, the deformity is of a complicated character, as when it is associated with organic disease of the spine, serious lesion of the nervous system, or a crippled state of a large number of muscles, the patient may consider himself fortunate if he obtain any relief at all.

In the *treatment* of this affection the first indication is to ascertain, if possible, the nature of the exciting cause, and then to regulate ourselves accordingly. If it depend upon rheumatism, the diagnosis may usually be easily determined by observing that this disease exists at the same time in other parts of the body, and that the muscles of the neck are extremely painful and intolerant of motion and manipulation; more or less fever will probably be present, and the features will exhibit a wan and contracted appearance, expressive of the local and constitutional distress. If the case be seen early in the attack, bleeding by leeches will prove beneficial; the bowels should be well moved; and the system should be promptly brought under the influence of calomel and opium, followed by colchicum. Anodyne embrocations, and the application of steam, directed to the part by means of a tube, will be the most suitable local remedies.

A careful examination will generally be sufficient to detect the presence of organic disease of the cervical vertebræ. The most important signs are, the existence of the strumous diathesis, unnatural projection of the spine, and the impossibility experienced by the patient in performing the most simple movements of the neck. The proper treatment will be the prone position, maintained for months together, and a course of alterants and tonics, with a caustic issue at the seat of the disease.

Paralysis of the sterno-cleido-mastoid muscles has been more frequently accused as a source of wryneck than it probably deserves. Very few of the cases that have fallen under my observation could be traced to such an origin. The affection usually begins insidiously, and may depend upon various causes, especially disorder of the digestive organs and of the cerebro-spinal axis. It may affect both muscles, but, in general, it is limited to one, and then the other, continuing its function, contracts upon itself, and is eventually converted into a dense, rigid cord, in obedience to a law that a muscle, deprived of antagonism, is gradually reduced to a kind of fibrous mass, much below the volume of the original. The diagnosis is easily established by a careful examination, which will disclose the great differences in the state of the two muscles, the excessive distortion of the features, and the atrophied condition of the face on the side corresponding with the contraction.

The treatment must be directed to the removal of the exciting cause; where this cannot be detected, the case must be managed upon general principles. Gentle purgation, a judicious regulation of the

diet, and strict attention to the secretions, will always be beneficial, and must, therefore, not be neglected. Chalybeate tonics, the cold shower-bath, followed by dry friction with the flesh brush, and exercise in the open air, will be required for the weak and anemic. Shampooing and electricity have been highly lauded in this form of wryneck, but their value has been greatly overrated.

When the affection has reached its confirmed stage, the only remedy is the division of the contracted muscle, and it is well to know that nothing is to be gained in such a case by delay or by a resort to extending apparatus, however ingeniously constructed, or diligently and perseveringly applied. Such a hope is perfectly futile. The subcutaneous operation possesses great advantages over the direct section practised in former times, which always exposed the patient to severe suffering and to protracted suppuration, besides generally eventuating in an imperfect cure. The modern procedure is entirely free from all such contingencies. The only objection that can be at all alleged against it is the difficulty of its execution, but this, I am satisfied, has been greatly exaggerated, for there is no educated surgeon who need be afraid of undertaking it, provided he will recall to mind, at the time, his knowledge of the anatomy of the parts. None but the merest bungler could possibly injure the carotid artery or the internal jugular vein; and as to the external jugular, which lies just behind the sternocleidomastoid muscle, no serious harm could result from its subcutaneous division, as the bleeding could easily be controlled by pressure.

In performing the operation, which should be done while the patient is under the effects of chloroform, the head, inclined slightly forwards, should be held as firmly as possible by an assistant, while another has charge of the extremities. The left finger is then insinuated behind the sternal portion of the muscle, just above its origin, when a delicate tenotome (fig. 288), such as that used in the operation for club-foot, is inserted flatwise behind the muscle at its outer edge, and thence carried on in close contact with its posterior surface, until its point meets the finger on the opposite side.

Fig. 288.



The cutting edge being now turned forwards, the muscle is carefully divided from behind forwards by a sort of sawing motion, from nine to twelve lines above the sternum. The sudden retraction of the belly of the muscle, sometimes with a distinct noise, will denote the completion of the operation. If the clavicular portion be now found to be tense and resisting, the knife should next be passed beneath it, and its division effected in the same cautious manner. Bands of the cervical aponeurosis occasionally project, and may be severed with a narrow, blunt-pointed bistoury, having only about a line of cutting edge near its extremity. If the border of the trapezius be at fault, it may now be divided, and so of any other muscle, provided its proximity to the great cervical vessels and nerves does not absolutely forbid interference.

The above procedure is the one which I have always adopted, and in

no instance has it been attended by any casualty. The fact is, it is a very simple operation, and one entirely free from danger.

The puncture made with the tenotome is closed with a bit of adhesive plaster, and the patient is placed in bed with his head in a relaxed and easy position. Light diet is enjoined, and a mild purgative may be given the morning after the operation. As soon as he is able to get up, which will usually be in four or five days, the head should be

supported with a suitable apparatus, so constructed as to produce gradual extension of the affected side of the neck. Various contrivances of this kind may be obtained of any of the more respectable cutlers, all of them possessing more or less merit, and well calculated, if judiciously applied, to effect a cure, though not without protracted perseverance.

The annexed drawing (fig. 289) exhibits the apparatus of Professor Jörg, one of the best of the kind hitherto in use. It consists of a leather corset for the chest, and a firm band for the head, connected by a steel rod, which is moved by a ratchet-wheel, turned by a key, the whole arrangement being



Professor Jörg's apparatus for torticollis.

such as to permit the head to be moved to one side or the other at pleasure. The cure is promoted by daily frictions with stimulating liniments.

### SECT. III.—DISEASES OF THE THYROID GLAND.

The thyroid gland is subject to various diseases, of which abscess, serous cysts, and hypertrophy are the most frequent and important. The heterologous formations rarely affect this organ.

1. *Abscess*.—Abscess of the thyroid gland is very rare; it is attended by the usual symptoms, and may, when neglected, acquire a large bulk, hanging down the neck like a big pouch. In its earlier stages, it is not always easy, or even possible, to form a correct idea of the nature of the disease; but when the quantity of matter is considerable, its presence will be indicated by a sense of fluctuation, by pain and difficulty of breathing, and by a swollen, discolored, and œdematous state of the integuments. These symptoms, joined with the history



of the case, and the concomitant febrile excitement, are quite sufficient, in every instance, to establish the diagnosis. The matter, bound down by the cervical fascia and muscles, is often long in reaching the surface, to say nothing of its tendency to extend down the neck, and its escape should, therefore, always be encouraged by an early incision in the lower part of the swelling.

Such an abscess is sometimes of a latent character. Many years ago, I attended, along with Dr. Woodward, of Cincinnati, a man, aged forty-four, who died of pneumonia, after an illness of three weeks. On inspection, I found the whole of the thyroid gland, with the exception of a small portion of its inferior extremity, converted into a thin, delicate sac, containing nearly ten ounces of thick, yellowish pus, free from odor. The thyroid cartilage was completely denuded, and the matter had burrowed upwards, underneath the hyoid bone, on the left side, as far as the root of the tongue. No symptoms, whatever, indicative of disease of the thyroid gland, had existed during life. The abscess was evidently of a strumous character.

2. *Cystic Tumors*.—This organ is, at times, the seat of serous cysts, similar to those of the liver, brain, ovaries, and other structures. Varying in number, in different cases, from one to several dozens, they are situated either directly in front of the neck, or at one side of the middle line, and are found of all sizes, from that of a cherry-stone to that of an egg. They are composed of thin, elastic coats, and are occupied by a watery, yellowish, or oily-looking fluid, coagulable by heat, alcohol, and acids, thus showing its albuminous constitution. The development of these tumors is, in general, very tardy; they are free from pain and discoloration of the integuments, and they communicate to the finger a soft, elastic sensation, which readily distinguishes them from solid tumors in the same situation. The disease is rarely met with under the age of twenty-five or thirty.

The *treatment* of the cystic tumor of the thyroid gland is similar to that of hydrocele, and may be conducted by incision, injection, or seton, the latter of which is usually the most certain and efficient. When there are several such tumors, the best plan is to treat them with the tent, retained until there is a sufficient amount of inflammation to protect the cavity against reaccumulation. Excision may be necessary when the coats of the cyst have undergone the fibrous, cartilaginous, or osseous degeneration.

3. *Goitre, or Bronchocele*.—Goitre, technically termed bronchocele, is a chronic enlargement of the thyroid gland. The affection, which is much more common in women than in men, and in children than in adults, not unfrequently exists as an endemic, especially in the valleys of the Alps, Apennines, and Pyrenees. In this country, it is often observed in the mountainous regions of Vermont, New Hampshire, Connecticut, New York, Virginia, and Pennsylvania. In our southern States it is uncommon. It has occasionally been noticed among our aborigines, but not to any extent. I have never seen an instance of it in the negro. In England, it is very common in Derbyshire, Norfolk, and Surry. In the valleys and gorges of the Alps, it is frequently associated with cretinism. The afflicted being has a short, stunted

body, shrivelled limbs, a large, unseemly head, a vacant countenance, and a depraved intellect. In fact, in many cases, he is idiotic.

The *cause* of bronchocele is evidently closely connected with the locality in which the disease occurs. Low and moist situations are most obnoxious to it, while high and airy regions are comparatively exempt. Confined, ill-ventilated places, affected with frequent inundations, are remarkably favorable to its production. It is probable that the habitual use of water, strongly impregnated with calcareous matter, is a powerful predisposing cause. Goitre seldom makes its appearance, even in countries where it is indigenous, before the tenth or twelfth year. Occasionally it is hereditary, and it not unfrequently occurs in several members of the same family. It has been observed in the horse, cow, sheep, dog, and other inferior animals.

The *tumor* varies in size, from the slightest increase of the natural volume of the gland to that of a fist, a cocoa-nut or an adult head. When of the latter dimensions, it may reach as high up as the ears, backwards as far as the trapezius muscle, and downwards over the sternum, forming a most disgusting and shocking mass. Both lobes are usually affected, though seldom in an equal degree. Sometimes the disease is confined exclusively to the isthmus, or to this part and to one of the lateral lobes. The swelling increases very slowly, and often remains stationary for years together. Its surface may be smooth and uniform, or rough and lobulated. A very common accom-

paniment is an enlargement of the subcutaneous veins. No pain attends goitre, except what results from its pressure on the neighboring structures; the skin is free from discoloration, and the general health is unimpaired. When the tumor is of unusual bulk, there may be difficulty of breathing, headache, vertigo, noise in the ears, and an altered state of the voice, which often becomes hoarse and croaking. In such cases the trachea is more or less flattened, elliptical, or even triangular, from the pressure of the superincumbent mass. The ex-

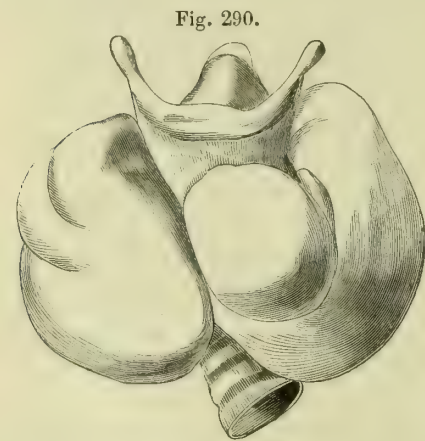


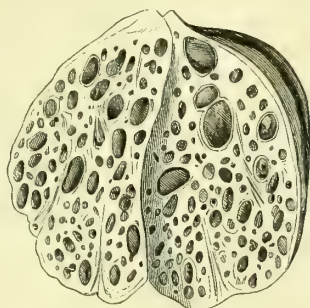
Fig. 290.

ternal characters of goitre are well exhibited in the annexed drawing (fig. 290), from a preparation in the Mütter collection.

The *internal structure* of the tumor is liable to considerable variety, depending upon its age and progress. When of moderate standing, it is generally of a soft, gelatinous consistence, emitting, on pressure, a ropy, glutinous fluid. In more ancient cases it is of a pale cinnamon tint, hard to the feel, and interspersed with numerous cysts, generally not larger than a pea, containing a serous, glairy, or melicerous substance, and occasionally pus, fibrin, or even pure blood. These cysts are merely enlarged cells, which are dispersed through the organ in the natural state. Fig 291, taken from one of my specimens, exhibits

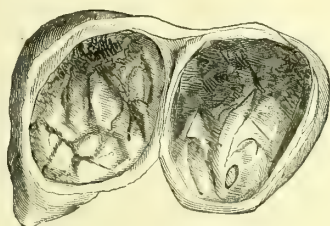
these cavities hypertrophied from disease, and occupied by a white, semi-concrete substance, similar to coagulated lymph. Calcareous concretions are sometimes found, either alone or in union with cartilaginous and osseous productions. In a small goitrous tumor, obtained

Fig. 291.



Cystic degeneration of the thyroid gland.

Fig. 292.



Ossified thyroid gland.

from a man fifty years of age, and now in my private collection, there are several small steatomatous masses, with a circular nodule of bone, about six lines in diameter. It is of a yellowish color, very compact in texture, and surrounded by a thin, imperfect capsule. Occasionally the whole organ is transformed into an osseous cyst, filled with various kinds of matter, especially the jelly-like, the suety, and the meliceric. I have a specimen of this kind in my cabinet; one of the lobes has almost entirely disappeared, whilst the other is converted into a firm, solid capsule, as hard as bone, though scarcely a line in thickness (fig. 292). On sawing through this osseous tumor, which does not exceed the volume of a hen's egg, I found it filled with a white, curdy, friable substance, not unlike semi-concrete cheese.

The *diagnosis* of goitre is usually sufficiently easy. Its early appearance, its tardy progress, its situation in front of the neck, its indolent character, and its ascent with the larynx and trachea in deglutition, leave little room for doubt in any case. The diseases with which it may be confounded are aneurism of the carotid artery, varix of the internal jugular vein, encysted tumors, and swelling of the lymphatic ganglions.

When goitre is extensive and occupies the side of the neck, a part of it will necessarily project over the carotid artery, and thus receive its pulsation. In this manner the disease might easily enough be mistaken for *aneurism*. The signs of distinction are, the slow and indolent nature of the swelling, the absence of bellows-sound, and the facility with which the morbid mass may, in most instances, be pressed away from the cervical vessels, when the head is bent forwards so as to relax the muscles of the neck.

*Varix* of the internal jugular vein is uncommon. The enlargement is seated low down in the neck, just above the sternum, and forms a tumor of an oblong shape, about the size of an egg, soft, elastic, and compressible. It is of a bluish color, has a tremulous, pulsatory motion, and is diminished, or temporarily effaced, by pressure upon the distal portion of the vessel.



An *encysted tumor*, situated directly over the thyroid gland, may simulate goitre. Seldom exceeding the volume of a walnut, it is free from pain, partially translucent, soft, elastic, and obedient to the motions of the windpipe. When the diagnosis is at all equivocal, recourse is had to the exploring needle.

A *scrofulous lymphatic ganglion*, occupying the site of the thyroid gland, may prove a source of error. The history, however, of its origin and progress, the hardness of the swelling and its tendency to suppurate, the presence of the strumous diathesis, and the existence of similar enlargements in the neighboring parts, will always be sufficient to enable the surgeon to distinguish between the two affections.

The *treatment* of goitre is generally conducted too much upon empirical principles. Hence, failure is too commonly the rule; success the exception. At the present day, reliance is mainly placed upon iodine and its various combinations, aided by the use of leeches, blisters, and purgatives. It must be obvious that no remedies, however valuable in themselves, or however judiciously and faithfully employed, can avail in every instance. When the tumor is of long standing, when it has attained a large bulk, and, above all, when it has undergone some of the transformations previously adverted to, no mode of treatment whatever will be likely to make the slightest impression upon it. Such cases are literally hopeless. It is only in the milder forms of the disease, and in its earlier stages, that any decided benefit is to be looked for. My own plan has been, for many years, to subject the patient to a sort of preliminary treatment, consisting of light diet, and gentle, but steady, purgation. When plethora is present, a full bleeding may be advantageously premised. After the lapse of ten or twelve days, the use of iodine may be commenced, either in substance, or in the form of Lugol's solution. The tincture I rarely employ, as it is apt to prove irritating. In whatever form iodine is administered, it is best always to combine with it a small quantity of opium or hyoscyamus; the dose should be graduated according to the age and susceptibility of the patient, and the effects of the remedy should be carefully watched. After it has been taken for a fortnight or three weeks, its use should be suspended for several days, when it may be resumed and continued as before. In some instances, the protiodide of mercury will exercise a beneficial influence, especially if carried to slight ptyalism. This article is particularly serviceable in recent cases, in which the swelling mainly depends upon interstitial deposits. The bowels are in no instance to be neglected. Much purging, however, is neither necessary nor proper. The diet should be vegetable and farinaceous. Change of residence is frequently indispensable, especially when the individual lives in a country where the disease is endemic.

The topical treatment consists of the inunction of iodine, aided by leeching and blistering. The detraction of blood from the affected part is almost always beneficial, from the tendency which it has to unload the capillary vessels, and to rouse the absorbents. From ten to a dozen leeches may be applied every six or eight days, directly over the swelling, and the bleeding be encouraged by fomentations. In some instances a rapid reduction of the tumor is effected under the use of

blisters, reapplied once a week. But I have found no local remedies so efficacious as a combination of equal parts of iodine and camphorated mercurial ointments, rubbed thoroughly upon the tumor twice a day. A piece of oil silk is worn next the skin, and over this, in cold weather, a piece of flannel, for the double purpose of preventing the unguent from soiling the dress and keeping the neck sufficiently warm. In whatever form iodine be applied, care should be taken that it is not so strong as to fret and irritate the skin, otherwise inflammation, and not absorption, will be the result.

The *seton*, first recommended by Celsus, and again, in 1824, by Dr. Quadri, of Naples, has been frequently used in the treatment of goitre, and occasionally patients have been thus cured. The only case, however, to which it is at all applicable, is where the tumor contains one or more large cysts, which, being traversed by the foreign substance, may be thereby obliterated. The insertion of the seton has sometimes been followed by copious hemorrhage; and in several instances the patient has perished from the violence of the resulting inflammation. At present the practice is nearly obsolete.

*Starvation* of the tumor, by tying the thyroid arteries, has been practised, but without any encouraging results. The operation was first executed by Mr. Blizzard, of London, and since then by Walther, of Germany, Dr. Jameson, of Baltimore, and several other surgeons. In some of these cases no inconvenience ensued, and the bronchocele, in a short time, became considerably reduced in size; in others, no visible effect of any kind was produced; while in a third class the patient either died of hemorrhage or of inflammation. Whether the diminution of volume was permanent, in any instance, we have no means of determining. The probability, however, is that it was not; for such is the amount of blood which the tumor receives, and so great the number of anastomosing vessels, that its proper circulation would, no doubt, be speedily re-established.

When the tumor resists our curative efforts, and endangers suffocation, it has been proposed to afford relief by *extirpation*. But the question arises, is such a procedure proper or justifiable? In a word, can the thyroid gland, when in a state of enlargement, be removed with a reasonable hope of saving the patient? Experience emphatically answers, no. This conclusion is not invalidated by the fact that the operation has, in a few instances, been performed successfully. By no means. It only proves that an undertaking may occasionally be accomplished under circumstances apparently the most desperate. What has once been effected may be effected again. But no sensible man will, on slight considerations, attempt to extirpate a goitrous thyroid gland. If a surgeon should be so adventurous, or fool-hardy, as to undertake the enterprise, I shall not envy him his feelings, while engaged in the performance of it, or after he has completed it, should he be so fortunate as to do this. Every step he takes will be environed with difficulty, every stroke of his knife will be followed by a torrent of blood, and lucky will it be for him if his victim live long enough to enable him to finish his horrid butchery. Should the patient survive the immediate effects of the operation, if thus it may be called,

death will almost be certain to overtake him from secondary hemorrhage, or from inflammation of the cervical vessels, œsophagus, and respiratory organs. When the tumor is large, the wound is of frightful extent, involving all the most important and delicate structures of the neck, and rendering it altogether improbable, from the constant motion of the windpipe and œsophagus, that much of it will unite by the first intention. Thus, whether we view this operation in relation to the difficulties which must necessarily attend its execution, or with reference to the severity of the subsequent inflammation, it is equally deserving of rebuke and condemnation. No honest and sensible surgeon, it seems to me, would ever engage in it.

Finally, when the case is utterly hopeless, and life is threatened by suffocation, temporary relief may occasionally be afforded by the subcutaneous division of the cervical aponeurosis and muscles, at the seat of the greatest constriction, thereby removing tension and pressure from the respiratory passages.

4. *Malignant Disease*.—I am not aware that colloid has ever been noticed in this gland; but this organ is occasionally the seat of scirrhus, encephaloid, and melanosis. The deposits sometimes exist as a primary affection, but more generally they show themselves in connection with carcinoma in other parts of the body, as the liver, mamma, testis, alimentary canal, uterus, and lymphatic ganglions. In the former case, the malady is most common after the age of forty, and usually exhibits itself in the form of small nodules, dispersed through the substance of the gland, which often retains its integrity in the midst of the heterologous matter. At other times, it is seriously changed in its character, the organ itself being enlarged and deformed. The diagnosis of these affections is generally obscure, and hence they often prove fatal before an opportunity is afforded for ascertaining their real nature. Their presence may usually be suspected when the thyroid gland, in advanced life, is the seat of sharp, lancinating pains, when the affected part steadily augments in size and consistence, when the skin becomes adherent and discolored, and when there is great and progressive emaciation, with hectic irritation, a sallow, sickly expression of the countenance, and the existence of malignant deposits in other organs. Encephaloid here, as elsewhere, always proceeds more rapidly than scirrhus; the tumor also acquires a much larger bulk, there is commonly great enlargement of the subcutaneous veins, and the general health is earlier and more severely affected. In melanosis, which is still more rare than scirrhus and encephaloid, the tumor is seated just beneath the skin, and occasionally imparts its peculiar color to it. Nothing is to be expected from medicinal means in these diseases, any more than in similar affections in other parts; and, as to extirpation, I know of no circumstances that would render it advisable.

#### SECT. IV.—ENCYSTED AND OTHER TUMORS.

Various tumors, mostly of an innocent character, are liable to form in front of the neck, often very embarrassing in their diagnosis and



treatment. A very brief account of some of the more important of these growths is all that will be necessary.

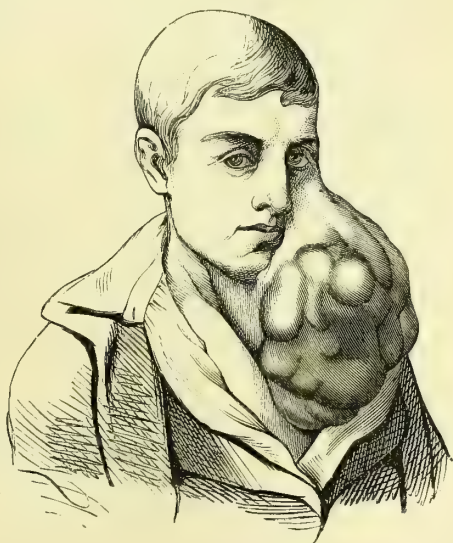
1. *Synovial Burse*.—An encysted tumor sometimes forms in the upper and forepart of the neck, taking its rise in the synovial sac, situated between the hyoid bone and the notch of the thyroid cartilage. This sac, which, in its natural state, is hardly a few lines in diameter, may, in consequence of inflammation, acquire the volume of an egg, if not of a small orange. It is of an oblong shape, elastic, slightly translucent, and filled with a thin, serous, oily, or viscid fluid. The superincumbent skin is healthy, and the swelling is entirely free from pain. The treatment is by seton, injection, or incision, as in encysted tumors in other parts of the body.

2. *Sebaceous Tumors*.—Occasionally a solid tumor forms in the thyrohyoid region, and produces considerable disfigurement. In 1841, I removed a swelling of this kind from the neck of a young lady, at that time a resident of Louisville. It made its appearance at an early age, and had attained the bulk of a large orange. The tumor was free from pain or discoloration, and was slightly movable from side to side. It extended upwards nearly as far as the chin, while below it overlapped the thyroid and cricoid cartilages. The operation was not difficult, and the patient made a speedy recovery. No vessels required to be tied. The tumor was occupied by a tough, putty-like substance, and had evidently originally been of a sebaceous character.

3. *Fibrous Tumors*.—A fibrous tumor now and then forms in front of the neck, and may, in time, acquire an enormous bulk, seriously interfering with the patient's looks and comfort. The annexed drawing (fig. 293) exhibits a growth of this description, removed by me from a youth of seventeen. It had been in progress for several years, and, although free from pain, was productive of great inconvenience. After removal, it was found to weigh upwards of five pounds, and to present a beautiful specimen of the fibrous structure. The tumor was situated superficially, but much care was, nevertheless, required in its removal on account of the great enlargement of the subcutaneous and other veins.

4. *Serous and Bloody Tumors*.—An encysted tumor, occupied by serum, blood, or sanguinolent matter, occasionally forms in front of the neck, between the sternum and the thyroid gland, taking its rise apparently in the cellular substance be-

Fig. 293.



tween the sterno-hyoid and sterno-thyroid muscles. Its progress is chronic, and it seldom acquires a volume larger than that of a small orange, which it also generally resembles in shape. It fluctuates distinctly under pressure, is free from pain, and readily obeys the movements of the larynx during efforts at deglutition, rising as the tube ascends, and falling as it descends; circumstances which, together with its tardy development, the absence of enlargement of the subcutaneous veins, and the impaired condition of the general health, are always diagnostic of the nature of the affection. The encysted tumor, according to my observation, is almost exclusively met with in young and middle-aged females. Cases occur in which it is congenital.

The proper remedy for this morbid growth is excision; which, with proper care, may always be performed with perfect safety. The knife should be used in such a manner as not to penetrate the cyst, since, if this happen, the operation will be one of great difficulty, whereas, under opposite circumstances, removal may generally be effected by enucleation. Very little hemorrhage attends the procedure, and the recovery is usually rapid. I have seen a number of cases where this tumor was greatly diminished by the long-continued application of iodine, but I have never known the treatment to be followed by a permanent cure.

5. *Abscess*.—The synovial pouch in front of the neck, or the parts immediately over it, may become the seat of an abscess. It may have an independent origin, or it may be caused by reflected irritation from the throat, windpipe, or lungs. The symptoms may be so obscure that the disease may elude detection during life. In general, however, there is more or less tumefaction of the affected part, difficulty of swallowing, spasmodic cough, and a sense of strangulation. An early incision is required, to prevent the abscess from bursting into the windpipe.

## CHAPTER IX.

## INJURIES AND DISEASES OF THE CHEST.

## SECT. I.—WOUNDS OF THE CHEST AND LUNGS.

WOUNDS of the chest, like those of the abdomen, necessarily divide themselves into external and internal, or those which affect the wall of the chest, and those which implicate its contents. They may, as in other parts of the body, be of various kinds, as incised, lacerated, punctured, or gunshot, and they may be either simple or complicated, according to the nature and amount of tissue involved in the injury.

External wounds of the chest, unless accompanied by severe concussion, profuse hemorrhage, or fracture of the ribs, are rarely attended with any particular danger, and require no other treatment than that which regulates the conduct of the practitioner in the management of wounds in general. When the lesion is considerable, it may be necessary, especially if the patient is harassed with cough, to adopt means for securing the quietude of the chest by the application of a broad bandage and the occasional exhibition of an anodyne draught; but under ordinary circumstances both these expedients may be dispensed with. Any foreign substance, as a splinter of wood, a ball, or a loose piece of bone, must, of course, be removed, either on the instant, or as soon as its situation is rendered obvious. The direction which a ball sometimes pursues upon striking the chest, especially if it come in contact with the sternum, spine, or ribs, is very remarkable, and is well worthy of remembrance in a practical point of view. Thus, instead of lodging at or near the point of entrance, it has been known to make almost the entire circuit of the thorax, passing underneath the integuments, and becoming arrested a short distance from the point of ingress, or, perhaps, issuing even at the same orifice, as has occasionally happened in military engagements. When this is the case, the course of the projectile is generally indicated by a reddish or purplish line, which will be more distinct in proportion to the size of the ball; and, in addition to this, there is not unfrequently a crackling sensation imparted to the finger as it sweeps over the chest in pursuit of the intruder, caused by the presence of air. In some instances the ball lodges between two ribs, perhaps splintering them, and finally effecting an entrance into their substance.

*External wounds* of the chest are seldom attended with much hemorrhage; it is only when one of the intercostal arteries is laid open that there will be likely to be much bleeding, and in that event the proper procedure will, of course, be the ligation of the vessel. The operation,



however, is generally difficult, if not impossible, owing to the deep situation of the vessel. When this is the case, I should not hesitate to drill a small aperture into the rib, just above the artery, and to pass a silver wire round its bleeding orifice. Such a procedure, although apparently harsh and unscientific, would not, I suppose, involve any special risk from inflammation of the pleura. Lesion of the internal mammary artery is occasionally followed by hemorrhage into the anterior mediastinum. If so copious as to compress the heart and lungs, or cause great exhaustion, the proper plan will be to expose and ligate the vessel at all hazards.

Wounds involving fracture of the ribs or sternum must be treated upon the same general principles as fractures of these bones without such lesion of the soft parts, that is, the movements of the thorax must be controlled with the bandage, and cough and pain allayed by anodynes and appropriate antiphlogistic measures.

*Internal wounds* of the chest are much more serious accidents than external; they are generally made by balls and sharp-pointed instruments, as knives, dirks and bayonets, and are often attended with severe lesion of the contents of the thoracic cavity, terminating life either on the spot, or at a period more or less remote from the occurrence of the injury. Hence their effects may be conveniently arranged under two heads, the primary and secondary; the former including shock, collapse of the lung, hemorrhage, and pneumothorax; the latter, inflammation and its consequences, as accumulations of serum, lymph, and pus in the pleural cavity.

Internal wounds of the thorax may be further divided into those which merely pierce its walls, without inflicting any injury upon its contents, and those in which the contents participate in the mischief.

Death from mere *shock* is by no means uncommon in wounds and injuries of the chest; cases of the kind are frequently met with both in civil and military practice, and their occurrence has occasionally been noticed where, upon dissection, no serious lesion has been detected to account for so untoward a result. The treatment of such cases does not involve anything peculiar, as it does not differ from that of shock from other causes. Our principal reliance must necessarily be upon sinapisms and stimulants, especially in the form of enemata, with opium, to calm the nervous system and sustain the heart's action; but great caution should be observed in their use, particularly if there be reason to believe that the depression is dependent, in part, upon intra-thoracic hemorrhage, lest by the induction of early reaction the bleeding should be encouraged instead of being repressed.

*Collapse* of the lung is a very common, although by no means a necessary, effect of a penetrating wound of the chest. The occurrence will be most likely to happen when the wound is direct and of large size; under opposite circumstances, and especially when the opening presents a valvular arrangement, or when the passage leading from it is long and devious, the air will find it difficult, if not impossible, to enter the chest to such an extent as to counterbalance that in the lung, which will thus, consequently, retain its natural position. Even when the wound is of considerable size the organ is sometimes found to resist col-

lapse, as is proved by the fact both that the respiration is unembarrassed and that the lung is seen moving to and fro beneath the aperture in the thoracic wall. Still more satisfactory proof is occasionally furnished by the protrusion of a portion of the lung across the wound in the chest, thus constituting what has been, curiously enough, called pulmonary hernia, or *pneumonocele*.

Collapse of the lung is always a serious occurrence, as the patient is thus generally instantly deprived of one-half the quantity of air which he was accustomed to breathe before he was injured; if both organs be similarly affected, the difficulty will, of course, be proportionably increased, although even then the case is not necessarily fatal; for both clinical observation and experiments on the inferior animals have shown that the lungs, under these circumstances, so far from collapsing, may become so completely distended with air as to project from the thoracic cavity on each side, and yet the subject make a very rapid and satisfactory recovery. It is not improbable that the state of the patient's strength exerts a considerable influence upon the production of collapse; the accident being more likely to take place when he is exhausted by shock and loss of blood than when he is able to command the free use of his respiratory muscles. In the former case, he is very much in the condition of a person who is partially asphyxiated, and, consequently, incapable of distending his lungs, which are thus easily collapsed by the accidental ingress of the smallest quantity of air; in the latter, on the contrary, his efforts, which are often very violent, enable him effectually to resist the encroachment, and even to force the lungs somewhat out of the chest.

Collapse of the lung is characterized by excessive dyspnoea, the patient struggling violently for breath, and throwing himself about in the greatest distress and anguish; the ribs on the affected side are immovable, the respiratory murmur is completely absent, the voice is weak and indistinct, and percussion elicits an unusually clear resonance. With these symptoms are conjoined those of sudden and severe prostration, as excessive pallor of the countenance, a feeble, almost imperceptible pulse, and clammy sweats, followed by coldness of the extremities.

When the chest is pierced without collapse of the lung, the air generally makes a peculiar noise as it rushes into the pleuritic sac; and if the opening of communication is sufficiently large, the lung may be seen to move up and down in consonance with the egress and ingress of the atmosphere, filling, perhaps, the whole, or, at any rate, the greater portion of the thoracic cavity. The voice is not materially changed, if any, and the vesicular murmur is nearly natural, although the respiration is performed with great labor and difficulty. Soon after the accident there will be an escape of blood at the wound at each effort at inspiration, and if the pulmonary tissue has been injured, the patient will cough up blood, or, perhaps, have actual hemoptysis, especially if some of the larger vessels have been divided.

The *treatment* of penetrating wounds of the chest requires, in the first place, accurate closure of the orifice of communication, provided there are no contra-indications; and, in the second, the employment of

such measures as shall tend to prevent the occurrence of severe inflammation of the pleura and lung, which is so liable to happen after all injuries of this kind, even when the latter organ is not directly implicated.

If any foreign substance is present, it should promptly be removed, provided it is easily accessible, for the rule here, as in all other visceral cavities, is to refrain from all officious interference. Nothing, under such circumstances, can more clearly betray the ignorance of the surgeon than the introduction of the probe into the chest; a careful exploration of the outer wound is always admissible, especially when suspicion exists that a rib has been fractured, or that a ball has lodged in one of the intercostal spaces. If a probe be required, the finger, if not too large, will always answer that object better than anything else.

I have met with cases of shot wounds of the chest where the ribs were so much splintered as to require removal with the cutting-pliers; but the instances demanding such a procedure must necessarily be uncommon, and, in general, the duty of the surgeon is limited to the extraction of the loose, or partially detached, fragments. Such cases, it need hardly be added, are extremely apt to prove fatal.

If the lung is collapsed, an attempt may be made to draw the air out of the thoracic cavity with a large syringe, but such a procedure will generally be unnecessary, as the organ will of its own accord soon regain its natural position. If a portion of lung protrude, or puff out through the wound, it should immediately be returned, and proper means taken to prevent a recurrence of the accident. On no account should it be excised, not even if it be gangrenous, as might happen if a number of days have elapsed since the receipt of the injury, or if the case has been injudiciously treated. Under such circumstances, the separation of the slough should be promoted by mild applications, and when this has been effected any outward tendency on the part of the lung may easily be counteracted by graduated compression during the granulating and cicatrizing processes. I am aware that a number of cases have been reported of excision of portions of the lung thus protruded, but such cases should certainly not be taken as guides of practice, or as examples for our imitation.

When the wound is very large, it should be closed with a suitable compress, but, in general, this object may be attained by adhesive strips, or collodion plaster. Cases occur in which, when the orifice is very capacious, occlusion may be effected by sliding the integuments down over it from the parts in its immediate vicinity. Such a procedure would, of course, be objectionable in the event of there being extensive injury of the bony case of the chest.

Collapse of the lung, partial or complete, is sometimes produced by an accumulation of blood within the chest, occurring immediately after the receipt of the injury. Should this be found to have proceeded from one of the intercostal arteries, the proper remedy will be the ligature, after which the blood may either be removed mechanically, or be permitted to drain off spontaneously, by making the patient lie upon the affected side, so as to render the wound, if possible, the most dependent part of the body. If, on the other hand, it is evident that



it has been derived from the lung itself, the best thing that can be done is to let it remain, in the hope that, by compressing the wounded structures, it will serve as a hemostatic.

When the lung retains its natural position within the chest, the inflammation consequent upon the injury soon causes it to adhere to the edges of the wound, and, in this manner, all communication between the exterior and the pleuritic cavity is generally speedily cut off; an occurrence which is one of the greatest safeguards that can possibly happen in such a case. If, on the other hand, the lung is collapsed, it may be so tied down by effused blood and inflammatory deposits as never to regain its original situation.

To avert and moderate inflammation of the lungs and pleuræ in wounds of the chest is one of the great desiderata of our treatment, as this constitutes the chief source of danger in the event the patient survives the immediate effects of the injury. The principal agents for accomplishing this are the lancet, tartar-emetic and opium, purgatives, cupping, and counter-irritants, especially epispastics. If the system has not been too much drained of blood by the accident, the bleeding should be both early and free, and be repeated at short intervals until a decided impression has been made upon the disease; otherwise our chief reliance should be upon the use of tartrate of antimony and potassa, in union with anodynes, to allay pain and cough, and promote sleep. The bowels should be thoroughly moved by senna and sulphate of magnesia, or calomel and jalap; blood should be taken by cups or leeches from the chest, over the seat of the morbid action; and, if these remedies do not prove speedily successful, a large blister should be applied, care being taken to let it remain upon the skin until complete vesication has been produced. Many of these cases, however, do either not bear these depletory measures at all, or only to a very limited extent, and not a little judgment is often required to determine when to employ or to reject them. Perhaps our best guide, under such circumstances, is the state of the pulse and of the countenance; when the former is hard, full, and frequent, and the latter hot and flushed, lowering agents are plainly indicated, whereas, if the reverse be true, they should be refrained from, tonics and stimulants being, perhaps, used in their stead.

Penetrating wounds of the chest are extremely liable to be followed by serous, sero-sanguinolent, and purulent effusions, no matter what means may be adopted for their prevention. If the accumulation be trifling, it will generally disappear spontaneously, or under the influence of suitable local and constitutional remedies, as in ordinary pleurisy, or pleuro-pneumonia; but when it is abundant, means must be adopted for its removal, otherwise the patient will be extremely apt to perish. I have seen several cases of death simply from neglect of this precaution. The presence of fluid is denoted by the ordinary symptoms of thoracic effusion, of which absence of the respiratory murmur, dulness on percussion, excessive dyspnoea, harassing cough, and inability to lie on the sound side, are the most prominent and characteristic. If the accumulation is very great, there will be, in addition, partial effacement, and, perhaps, even bulging of the intercostal spaces,

thus imparting greater certainty to the diagnosis. All doubt, of course, vanishes if the fluid escapes at the external wound. The formation of pus is generally preceded and accompanied by rigors and hectic irritation.

The proper treatment of this accident is sufficiently obvious. If the external wound has not yet closed, the body is placed in such a position as to render that the most dependent part, and it is seldom that any other procedure will be necessary. In a case which was under my charge in 1848, in a patient, aged twenty, whose chest had been penetrated by a pistol ball, evacuation of the cavity could only be effected by placing him on his knees and elbows, at the same time raising the hips and lowering the head, thus making the orifice as dependent as possible, an operation which was repeated, for several weeks, at least three times in the twenty-four hours; the young man ultimately making an excellent recovery, with a collapsed lung. Before this expedient was resorted to, the fluid was occasionally drawn off with the syringe. Where no opening exists, or where it cannot be made available for the purpose in question, a new one should be made, care being taken to select the most suitable part of the chest for furnishing a ready outlet to the pent-up fluid, and to avoid injury to the intercostal arteries. Patency of the orifice is maintained by a proper tent, or canula, well secured to the side of the chest, lest it should slip into its cavity.

Injuries of the lungs not unfrequently exert a very prejudicial secondary effect upon these organs, eventuating in the production of abscess, or the development of phthisis, the latter being more likely to take place when there is an hereditary tendency to this disease. Such occurrences cannot always be avoided, but the fact that they may happen should be borne in mind by the surgical attendant, as this will be one of the surest means of preventing them.

Although balls and other foreign bodies, lodged in the lungs, occasionally become encysted, yet in the great majority of cases they ultimately produce extensive and fatal disorganization of the pulmonary structures. The time at which this result occurs is very variable. A man, aged thirty-five, shot at the battle of Novi, died at the end of seven years, the bullet being found near the base of the left lung, in a distinct membrane, surrounded by indurated tissue. His health, after he had recovered from the more immediate effects of his wound, remained tolerably good for four years, when he was seized with an increase of dyspnœa, nocturnal cough, and hectic irritation, with pain in the chest, and inability to lie on the right side. He had no other sign of pulmonary disease, but finally died completely exhausted. In a case related by Dr. M. H. Houston, of Wheeling, a piece of coarse domestic linen, evidently the patch of a bullet, about two inches and a half in length by two in width, when unrolled, was found in the left lung, twenty-five years after its introduction. The cavity in which it lay was opposite the fifth intercostal space, near the spinal column; it was lined by a smooth, tough membrane, and communicated with several of the bronchial tubes, into one of which the foreign substance projected, thus keeping up the cough and irritation which had so long

annoyed the patient. The ball, along with a piece of rib, had been extracted immediately after the receipt of the injury. In the chapter on gunshot wounds, allusion is made to a case where an ounce bullet was found in the right lung, in a distant cyst, forty-five years after its introduction. In a few fortunate instances, the foreign body has been ejected during a violent paroxysm of coughing, excited by its presence. In a case which I attended in 1848, with Dr. T. L. Caldwell, of Louisville, the ball, on dissection, was found lying loose upon the surface of the diaphragm, on the right side, the patient having survived the effects of his wound nearly one month. It had entered the chest between the tenth and eleventh ribs, two inches from the spine, and had perforated the base of the lung, which was completely collapsed.

Penetrating wounds of the thorax occasionally remain *fistulous* for an almost indefinite period. Such an event will almost certainly arise when the pulmonary and costal pleuræ fail to adhere for some distance around the more dependent parts of the external orifice, thereby forming a kind of pouch, in which the matter, furnished by the sac, is allowed to accumulate, instead of passing off as fast as it is poured out. The manner in which the pouch is usually emptied is by the patient placing himself in a particular attitude favorable to the escape of its contents; but as this is often irksome and inadequate, it is seldom that the case receives the requisite attention, and hence many years often elapse before a cure is finally effected. The proper remedy is a counter-opening, made at the most dependent portion of the sac, so as to admit of a ready drain, both during recumbency and in the erect posture, the puncture being prevented from closing by a tent or canula. In a case which was under my care, some years ago, I pierced the chest through the fifth intercostal space, directly over the pericardium, and soon succeeded in effecting obliteration of the adventitious cavity. The patient was a young man who had inflicted a penetrating wound between the second and third ribs, in front of the chest, with a hatchet, which flew off its handle, while he was engaged in nailing laths. The cure of these affections, which is generally followed by a remarkable retrocession of the wall of the chest, is sometimes promoted by weak astringent and detergent injections, or by injections of a very dilute solution of iodine.

Another unpleasant secondary effect of wounds of the chest is *necrosis* of the ribs and sternum, the exfoliation of which is generally a work of time and suffering, months not unfrequently elapsing before complete riddance can be effected of the disease. The existence of the lesion is usually indicated by a puffy and painful swelling of the part, by a foul discharge, and by the appearance of one or more cloacæ, leading from the surface to the dead bone below. As soon as the bone is found to be loose, no time should be lost in removing it, the same procedure being employed as in necrosis in other pieces of the skeleton.



## SECT. II.—HEMOTHORAX.

The hemorrhage which succeeds wounds of the chest, constituting what is called hemothorax, may proceed either from the lung, or from some artery in the wall of the thorax, as one of the intercostal, or a branch of the internal mammary; not unfrequently it is derived from both sources. The quantity of blood poured out varies from a few ounces to several quarts, and hence its effects upon the lung and system may either be very slight or exceedingly severe; perhaps, in the latter case, causing death by exhaustion within a few minutes after the accident, or putting life in jeopardy at a more remote period by inflammation and various deposits.

The *symptoms* which characterize intra-thoracic hemorrhage are such as denote loss of blood in other parts of the body, with the superaddition of respiratory embarrassment occasioned by the mechanical compression of the lung. The countenance is deadly pale, the pulse small, quick, and tremulous, the surface cold and clammy, the breathing oppressed, the head giddy, and the mind anxious. Thirst and restlessness generally exist in a high degree; the patient experiences a sense of weight in the chest, and is unable to lie on the sound side; the thoracic walls emit a dull sound on percussion; and, if the effusion be large, there will be entire absence of vesicular murmur, with a tendency to flattening of the intercostal spaces. Blood usually escapes at the external wound, and, in the event of injury of the pulmonary tissue, is also discharged by the mouth, either in a pure state, or mixed with frothy mucus. Hemoptysis, however, is not always present in penetrating wounds of the lung.

When blood escapes from the chest into the subcutaneous cellular tissue along the spine, it is apt to gravitate towards the loins, giving rise to an ecchymotic appearance of that region, which some, as Valentin, Larrey, Louis, and others, have been led to regard as pathognomonic of hemothorax, or effusion of blood into the pleural sac. This statement, however, must be received with some allowance; for it has been shown, on the one hand, that this phenomenon is often entirely wanting in hemorrhage of the chest, and, on the other, that it is present when there has been no injury of this cavity, simply as a consequence of a bruise or contusion.

The manner in which the blood in hemothorax is disposed of is subject to some diversity; when the quantity is small, it is generally absorbed, followed, probably, by some adhesive action of the pleura; if, however, the quantity be large, it will not only seriously compress the lung, but assuming the solid form, it will be sure to excite severe inflammation, eventuating in serous and other effusions, which thus greatly complicate and aggravate the original difficulty. Instances occur in which, along with the extravasated blood, there is a considerable accumulation of air, thus combining hemothorax with pneumothorax, and, of course, increasing the urgency of the symptoms and the dangers of the case.

It will thus be perceived that the *prognosis* of intra-thoracic hemor-

rhage is always serious, except in the minor and more unimportant cases. Death may occur within a few minutes after the accident, or the patient may recover from the primary effects, and perish from the secondary, particularly from the mechanical compression of the lung and the irritation which the blood excites by acting as a foreign body.

The *treatment* of this form of hemorrhage is by no means satisfactory, since it is based rather upon speculation than upon any well defined principles. The patient should lie on the affected side, and the wound be kept open, unless it be found that the escape of blood is so excessive as to threaten serious, if not fatal, exhaustion, in which event it must be promptly closed. The head and shoulders should be elevated, iced water applied to the chest, acetate of lead and opium freely given internally, and, if the strength be not too much impaired, blood taken from the arm, to the extent of slight syncope, the operation being repeated as often as there is a decided tendency to overaction and to recurrence of hemorrhage.

When the blood proceeds from the lung, a circumstance, however, which cannot always, or, perhaps, even generally, be ascertained, the most judicious plan, probably, will be to let it remain in the hope that it may exert a favorable hemostatic action upon the wounded part; but as soon as all apprehension is over in regard to a recurrence of the bleeding, as it generally will be in five or six days, the effused fluid should be evacuated by operation, either by enlarging the original wound, or, if this be situated unfavorably, by making a free opening through one of the intercostal spaces at the most dependent portion of the chest, or wherever the results of percussion and auscultation may unite in locating the extravasated substance. The respiratory organs must be incessantly watched, to guard them from harm, the slightest tendency to inflammation being promptly averted with the lancet, tartar-emetic, calomel, and opium, aided by thorough and early vesication of the chest.

### SECT. III.—PNEUMOTHORAX.

Pneumothorax is caused by injury of the substance of the lung, admitting of an escape of air into the pleural cavity, and, in some cases, also into the posterior mediastinum, and thence by the cervical vessels and nerves into the subcutaneous cellular tissue of the neck, trunk, and extremities. But in order that the latter occurrence may happen, it is necessary that there should not only be a wound of the lung, but likewise of the costal pleura. When these two conditions co-exist, it is easy to perceive how the air in the pulmonary vesicles may, during the expansion of the lung, be forced into the areolar structure beneath the lining membrane of the thoracic cavity, and thus constitute what is denominated emphysema. Collections of air in these situations may be caused by injury inflicted upon the lung through the walls of the chest, especially if the wound be very small, oblique, or valvular, thereby interfering with the outward escape of the fluid; or they may form independently of any external wound, in consequence of the

laceration of the pulmonary tissues by a piece of broken rib, or the sudden and violent compression of the lung during a fall of the body from a considerable height, although such an event must be extremely rare.

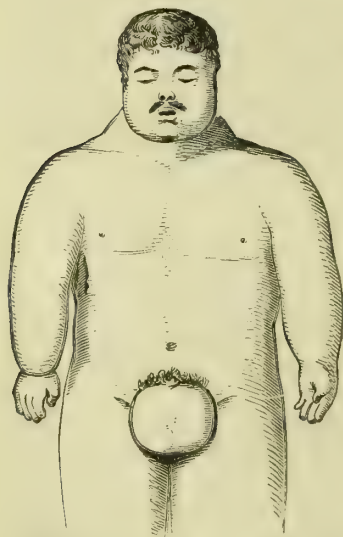
Emphysema of the cellular tissue of the trunk occasionally occurs without pneumothorax, as when a portion of lung that has become firmly adherent to the wall of the chest has been injured by the end of a broken rib being driven into its substance. In such a case, which is also one of extreme infrequency, the air may readily escape from the wounded organ into the areolar structure beneath the costal pleura, and from thence into that of the trunk and extremities, but cannot obtain access to the thoracic cavity.

The *symptoms* denotive of pneumothorax are generally of a very decisive nature. Percussion of the chest affords a remarkably resonant, or hollow, drum-like sound, wholly dissimilar from what is elicited in any other disease, and, therefore, of itself characteristic of the presence of air; the vesicular murmur is either much diminished, or entirely absent; the breathing is considerably embarrassed; the voice is feeble; difficulty is experienced in lying on the affected side; and the respiration in the sound lung is puerile.

The symptoms of emphysema are also distinctly marked. The puffy, colorless, and elastic swelling, crackling under pressure, and commencing at a particular part of the chest, either at the wound, or, if there be none, opposite a broken rib, and gradually spreading in different directions, is an unmistakable sign of the existence of air beneath the integuments. The air, in consequence of the permeable nature of the structure in which it is lodged, may readily be pushed from one place to another, especially soon after it begins to make its appearance; and occasionally travels with astonishing rapidity over the greater portion of the body, destroying all distinction of the chest, neck, and face, and thus inducing the most unseemly and frightful deformity, as seen in the adjoining sketch (fig. 294).

The *treatment* of pneumothorax and emphysema is very simple. In general, the air in the pleural cavity will be rapidly decomposed and absorbed; should it prove troublesome, by causing serious respiratory difficulty, it may be let out slowly by means of a delicate trocar, introduced so as to make a valve-like aperture, which should be closed immediately after with adhesive strips, aided by a compress and bandage. Emphysema is usually easily controlled by compression; but if it should threaten to become very extensive and inconvenient, or if

Fig. 294.



General emphysema of the whole surface, after wound of the right side of the chest.



it actually be so when advice is demanded, the most prompt and effectual remedy will be a moderately free incision at the seat of injury, or a number of little punctures in different parts of the body.

#### SECT. IV.—HYDROTHORAX AND PYOTHORAX.

Under these names may be described those collections of serum and of pus which supervene upon acute and chronic pleurisy, whether the result of accident or of disease. Collections of this kind are extremely common, and are of great surgical interest, from the fact that they may generally be removed by a very simple and safe operation.

In acute pleurisy large quantities of serum are frequently poured out in an astonishingly short time, especially when the disease is of great extent and of unusual violence. The fluid is generally thin, colorless, and intermixed with lymph; sometimes it is of a reddish hue, from the presence of hematin, and occasionally it is found to be remarkably yellowish, and of a thick, viscid consistence, not unlike copal varnish, or fresh olive oil.

It is very seldom that genuine pus is poured out in acute pleuritis, yet such cases are sometimes met with, and that, too, at an early period of the disease. I have seen several instances, chiefly in young, plethoric children, in which one of the thoracic cavities was literally filled with purulent fluid in less than a fortnight from the commencement of the disease.

The water in chronic pleuritis is generally much more abundant than in the acute disease, often amounting to a number of quarts, if not to several gallons. It is also more thick and turbid than in acute attacks, being usually of a light lemon color, and of a somewhat oleaginous consistence. Sometimes it is of a greenish, or reddish hue, and cases occur in which it contains blood and pus. The fluid, when drawn off, and allowed to stand for some time, generally separates into two parts; one, thin and viscid, like serum, occupying the top; the other, which consists of fragments of lymph and albumen, resting at the bottom. This disunion not unfrequently takes place during the sojourn of the fluid in the cavity of the chest.

Large quantities of lymph are often intermixed with this fluid; and instances are met with in which it consists almost entirely of pure pus, or, at all events, of a preponderance of purulent matter. When this is the case, the fluid is generally more or less fetid; sometimes, indeed, almost insupportably so. The quantity of pus is occasionally enormous, amounting, perhaps, to several gallons. When the disease is of long standing, the matter may be partly contained in separate cavities among the layers of adventitious membranes which are so liable to form under such circumstances. I have repeatedly met with cases of chronic pleurisy in which three or four such cavities existed; some being filled with pus, some with serum, and some with a mixture of these fluids, or of these fluids and of blood. Finally, it is proper to add, that old thoracic accumulations occasionally contain gas, and various kinds of concretions, especially the fibrous and fibro-cartilaginous.

The *effects* which these various effusions exert upon the lung, are generally very distressing, if not most disastrous, compressing and condensing its substance, so as to render it unfit for the purposes of respiration. When the quantity of fluid is very great, the organ is sometimes reduced to a mere cake-like mass, hardly as large as the hand, lying in the back part of the chest, by the side of the spinal column. In this condition it is occasionally bound firmly down by bands of lymph, so that, even if the fluid be ultimately gotten rid of, it remains afterwards incapable of expansion. Very frequently, also, especially in protracted cases, the pulmonary tissues become thoroughly solidified, in consequence of the mechanical compression to which they are subjected, thus rendering them hopelessly impervious to the air. The pleura, in chronic inflammation, is usually very much thickened from interstitial and surfacial deposits, and closely adherent to the surrounding parts.

The *diagnosis* of these collections is a subject of the deepest interest, and therefore deserving of special consideration. It is founded mainly upon three circumstances: first, the history of the case; secondly, the changes in the configuration of the thorax; and, thirdly, the alterations in the respiratory functions.

1st. The *history* of the case will show whether the effusion is the result of traumatic or constitutional causes; if the latter, whether the consequence of ordinary pleurisy, pleuro-pneumonia, or of tubercular disease; finally, whether the affection is acute or chronic, open or latent.

2d. Whenever the pleuritic effusion is unusually copious, it sensibly encroaches upon the *chest*, so as to cause a very manifest enlargement of the corresponding side; the intercostal spaces being not only abnormally widened, but perhaps thrust considerably beyond the level of the ribs. The diaphragm is also more or less depressed, and the heart is thrown out of its natural position, either to one side, or down towards the stomach. The extent of the dilatation of the chest varies in different cases, but rarely exceeds two inches. The best way of determining it is to measure both sides with a graduated tape, carried from a central point of the sternum, under the mamma, to the spinous process of the corresponding vertebra. The eye alone, however, is often quite sufficient to detect the difference, even though it be comparatively slight.

When the intercostal spaces are much distended, and there is at the same time great wasting of the tissues, fluctuation may occasionally be detected; but such an occurrence is very uncommon.

3d. The effects exerted by these effusions upon the *respiratory sounds* and movements are generally of an unmistakable character. The alteration of the vesicular murmur is always in direct ratio to the quantity of fluid, being deep and feeble when it is moderate, but entirely wanting when it is very abundant, except, perhaps, along the spinal column, where it may still be somewhat audible over a space a few inches in extent. When old adhesions exist between the pulmonary and costal pleuræ, as often happens in the upper part of the chest in tubercular disease, the fluid, unable to compress this portion of the

lung, may allow it to receive a certain quantity of air after respiration has ceased everywhere else. No friction sound is ever present when there is much fluid in the chest. To produce such an effect it is necessary that the two pleuræ should not only be roughened with lymph, but that they should be able to rub more or less against each other. *Ægophony* exists only when the effusion is moderate, or only a few lines in depth; hence it is not present either in the very early or in the more advanced stages of the disease. Finally, during certain movements of the body, especially if suddenly made, a splashing noise may occasionally be heard within the chest, resembling that produced by agitating a cask partly filled with water.

Dulness on percussion is always present when there is much effusion; commencing at the lower part of the chest, from which it gradually ascends as the fluid mounts upwards, and changing with the position of the patient. This symptom, however, considered by itself, is of no diagnostic value, inasmuch as it always attends solidification of the lungs, in whatever manner induced. When the pleuritic effusion is blended with the extrication of gas, percussion elicits a remarkably clear tympanitic sound.

The most important *functional symptoms*, especially in chronic pleuritic effusions, are hectic fever, rapid emaciation, pain in the chest, troublesome cough, a sense of tightness and oppression, great dyspnoea in ascending a flight of stairs, and inability to observe recumbency. If the patient lies down at all, he lies on the affected side, on his back, or in an intermediate posture.

Collections of water, or of water and pus, in the pleuritic sac, occasionally find their way out to the external surface; generally through one of the intercostal spaces, as in two cases which have been kindly shown to me by Dr. Da Costa. Sometimes the discharge takes place through the bronchial tubes. Le Dran, Andral, and others have recorded instances in which it was evacuated through the diaphragm. When the patient survives such an event, the track is lined by false membrane, and often remains fistulous for a long time.

But a spontaneous opening is a rare occurrence, and as the fluid, when existing in large quantity, cannot be brought successfully under the influence of the absorbents, the question naturally arises, How shall it be gotten rid of? for, if it be allowed to remain in the thorax, it must inevitably destroy the patient, and that in a short time. But one rational answer can be given to this question, namely, removal by operation. The operation called *tapping of the chest*, although occasionally performed by some of the older surgeons, was not placed in its true light until within the last ten years. In this country, attention was first prominently directed to the subject by Dr. Bowditch, of Boston, in a series of papers which have honorably associated his name with this department of pathology and practice. From the results of his cases, as well as from the results of the cases of other observers, it is evident that the operation, when properly performed, is not only perfectly safe, but generally eminently successful, the issue being always more favorable, other things being equal, in proportion to the shortness of the time that has elapsed since the com-



mencement of the disease, the excellence of the general health, and the absence of purulent matter. When the patient is much exhausted from protracted suffering and serious organic disease, the chances of recovery will, of course, be much lessened.

The operation of tapping the chest is very simple. The instruments which are required are a scalpel and a long, slender trocar, furnished with a stopcock to prevent the entrance of the air into the serous sac. The patient being comfortably propped up in bed, a small incision is made through the integuments, previously rendered tense, just above the upper margin of one of the ribs, generally the sixth, about midway between the sternum and spine, or just posterior to the digitations of the great serrated muscle. When the fluid points externally, the puncture is made at the most prominent and dependent portion of the swelling. The trocar is then thrust boldly through the intercostal space, penetrating the muscles and pleura, as well as any false membranes that may be adherent to its surface. The trocar being now withdrawn, the fluid will come away in a full stream, a suitable vessel having been provided for its reception. A large gum-elastic bag or beef's bladder, secured by a nozzle to the extremity of the canula, will be found to be the most eligible article for the purpose. When it is filled, the stopcock is shut until the bag can be reattached, and thus the operation is continued until the cavity is completely emptied. Upon withdrawing the canula, the integuments immediately resume their natural position, and thus effectually occlude the puncture. The edges of the outer wound are approximated by an adhesive strip, which is the only dressing required, the bandage being objectionable on account of its constricting effects.

The operation is generally well borne, especially if the patient is *slightly* under the influence of chloroform, which also, in great measure, prevents the cough that is otherwise so apt to attend it. If the patient becomes faint, his head should be gradually lowered, and free use be made of brandy. The former of these precautions will usually be required anyhow, with a view to complete clearance of the chest. As the fluid flows off, the lung, if not adherent or solidified, steadily expands, and at length regains its natural volume. If the accumulation has been very great, the operation will probably be obliged to be repeated several times before a final cure can be effected. The after-treatment is very simple; opium is given to allay cough and pain, and the system is supported by good diet and milk punch. When the case is very tedious, the fluids manifesting a strong tendency to reaccumulate rapidly after each operation, the cure may be expedited by the cautious injection of some slightly stimulating lotion, or simple tepid water, and the daily application of the dilute tincture of iodine to the walls of the chest.

Paracentesis of the chest is sometimes attended with injury to the lung, the point of the instrument being thrust into its substance. Such an accident, which, however, is seldom followed by serious consequences, will be most liable to happen when the organ has contracted firm adhesions. The intercostal artery is easily avoided by making the puncture in the lower part of the intercostal space, at a consider-

able distance from the inferior margin of the upper rib. Much outcry has been made about the risk of the entrance of air during the operation, but I am not aware of any case that has proved fatal, or that has led to any serious embarrassment from this cause.

The most valuable statistical facts relative to thoracic paracentesis are those furnished by Dr. John A. Brady, of Brooklyn, New York, consisting of an analysis of 132 cases. Of these, the operation eventuated in complete recovery in 79; 14 were relieved; and 37 ended fatally; in 1 the result was not known; and in 1 no benefit followed. In quite a number of the patients that died the disease had committed irremediable ravages before recourse was had to the operation. Of the 37 fatal cases, 11 were carried off by phthisis.

Dr. Bowditch, in a communication which he kindly addressed to me in May, 1858, stated that he had tapped 72 persons, making in all 125 punctures, during the last six years; but he made no mention of the relative number of recoveries and deaths. He added that in every case marked relief had followed. The ages of his cases ranged from four years to seventy-six.

Finally, the removal of the fluid from the pleuritic cavity, whether by medicine or operation, is always followed, especially in cases of empyema, by a remarkable contraction of the corresponding side of the chest, which generally remains during the rest of life, except when the patient is very young, and the lung regains its full expansion, when it sometimes nearly entirely disappears.

#### SECT. V.—WOUNDS OF THE HEART.

Wounds of the heart may be of an incised, punctured, or gunshot nature, according to the character of the vulnerating body; and their gravity is generally such as to lead very speedily to fatal results. Severe lesions are sometimes inflicted upon this organ without any serious injury of the integuments, or any solution whatever of their continuity, as in fracture of the ribs and sternum, in which some of the fragments are driven into its substance, or so rudely pressed against its surface as to cause more or less contusion. A case of gunshot wound is related in which, although the bullet did not penetrate the pericardium, yet the right ventricle of the heart was ruptured, and the pericardium filled with blood, the man dying a few hours after the accident. Such an occurrence can only be explained on the assumption that the ventricle was dilated at the moment of the percussion.

Wounds of the heart may be limited to the walls of the organ, penetrate its cavities, or affect its partitions. In the first case, they may be said to be superficial; in the other two, deep, and, consequently, of a more serious character. They are often complicated with other injuries, as fracture of the ribs and sternum, and wounds of the lungs, the diaphragm, and large vessels.

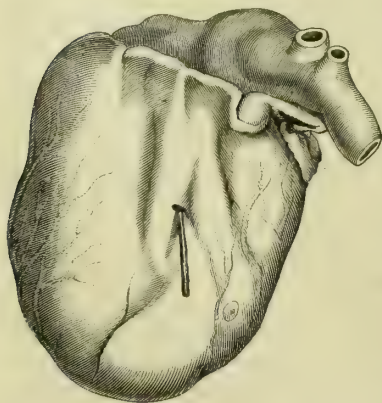
The *symptoms* of wounds of the heart are not always well marked, but often quite the reverse, thus occasioning great doubt as to their diagnostic value. In general, they are such as are indicative of severe

shock, whether from mere nervous depression or from loss of blood, which is often exceedingly profuse. The patient is faint, anxious, and deadly pale; the pulse is small, frequent, and irregular; the surface is cold and clammy; the pupils are dilated; the voice is feeble and indistinct; and the respiration is laborious, and often interrupted by sighs. The pain is usually very severe, especially in the region of the sternum; and, upon applying the ear to the heart, a peculiar noise is perceived, similar to that which is heard in aneurismal varix, or during the passage of blood from an artery to a vein.

These symptoms are, obviously, not pathognomonic; for they may be caused by various other lesions, as a wound of the lungs or large vessels. Important information may often be derived from a consideration of the situation and direction of the wound. Thus, if a knife, sabre, or ball has entered the chest on the left side, between the fourth and fifth ribs, about two inches from the sternum, and the patient is in the condition above described, there will be strong reason for concluding that the heart has been laid open, especially if the external wound has pierced the pleura. Probing, in such cases, can be of no use in any respect, and should, therefore, be avoided.

In *gunshot* wounds of the heart, the ball may lodge in the walls of the organ, or in the inter-ventricular septum, as in the interesting case related by Professor Carnochan. At other times, but this, also, is extremely rare, it may penetrate one of the cavities of the heart, and then fall into the inferior cava, descending, perhaps, nearly as far as the bifurcation of that vessel. Of this occurrence, a remarkable example is afforded by the unique case reported by Dr. Simmons, of a young man who received a pistol-shot in his chest, during my residence at Cincinnati, in 1835. He died at the end of ninety-seven hours, without having given any evidence whatever of being wounded in the heart. Upon dissection, however, an opening, pretty firmly closed by blood and plasma, was discovered in the upper part of the right ventricle, the inner surface of which exhibited a lacerated appearance, but no appreciable lesion existed in any other portion of the organ, and it was only by accident that the ball was detected in the inferior cava.

Fig. 295.



Wounds of the heart, although generally fatal, are not necessarily so. Much will depend, in every case, upon the nature of the injury, as its extent and direction. Sometimes a single shot is sufficient to cause death almost instantaneously, as happened in the case of a boy, aged seventeen, from which the accompanying sketch was taken (fig. 295). He was out gunning with his brother, who, in shooting at a rabbit, about twenty yards off, accidentally hit him in the chest, a stray shot passing through the left ventricle, near its middle. When a ball or knife takes



an oblique, tortuous course among the muscular fibres of the heart, their contraction may be such as to close the track made by the vulnerating body until a clot is formed, and so oppose, in great measure, the effusion of blood, thereby affording the wound an opportunity of undergoing reparation. However this may be, there are numerous instances upon record which serve to prove that recovery is by no means impossible. Thus, Dr. Randall, of Tennessee, has reported the case of a negro boy, who died sixty-seven days after having been wounded in the chest with a load of shot. The lesion was followed by severe inflammation of the lungs, but there was no indication that the heart had been injured, and the lad was thought to be convalescent, when he suddenly died from over indulgence in eating. Upon dissection, five shot were found in the heart, three in the base of the ventricle, and two in the bottom of the auricle; the wounds in the walls of the organ being all firmly healed, and the surfaces of its cavities exhibiting no trace of former suffering. In the case of a soldier, mentioned by Fournier, a musket ball was found in the right ventricle of the heart, in contact with its septum, six years after he had been shot. In the case of Poole, recorded by Dr. Carnochan, the probability is that recovery would have taken place if the man had been more careful of himself, and had not received other injuries. He died eleven days after the accident; and the dissection showed that the bullet, which was one-third of an inch in diameter, was enveloped in a delicate cyst, as it lay firmly imbedded in the muscular septum, midway between the apex and base of the ventricles, a quarter of an inch beneath the surface. The cause of death had been inflammation of the heart and pericardium, the latter of which was enormously distended with sero-sanguinolent fluid, encroaching greatly upon both lungs.

Some remarkable instances have been recorded of persons surviving a considerable length of time after the heart had been transfixed by foreign substances. Thus, Ferrus has narrated the particulars of the case of a man who lived for twenty days with a skewer traversing his heart, and Mr. Davis mentions one of a boy who lived upwards of a month with a piece of wood, three inches long, in the right ventricle.

The cause of death in wounds of the heart is hemorrhage or shock, if it occur soon after the accident, and inflammation, if it occur more remotely.

Wounds of the *pericardium*, uncomplicated with lesion of the heart, are occasionally observed, and their occurrence is probably more frequent than is generally supposed. A number of interesting cases of recovery from such injuries have been reported, their former existence having been satisfactorily verified by examination after death, months, if not years, after their infliction.

Wounds of the pericardium necessarily give rise to inflammation, the presence of which cannot always be recognized by the usual signs of that disease, as the friction sound may be entirely absent in consequence of the interposition between the membrane and the heart, of a large quantity of blood. When much fluid exists, whether it be pure blood, or serum, the precordial region will necessarily sound dull on

percussion, and often become preternaturally prominent, in the same manner as the thorax does in pleuritic effusion. The pulsations of the heart are irregular, tumultuous, and obscure, and the patient finds it difficult, if not impossible, to lie on his back without suffering from swooning, and a sense of impending suffocation. In a case which I saw with Dr. Knapp, of Louisville, auscultation for many days together afforded a peculiar lapping sound, similar to that made by a dog in lapping water, as if the heart had been splashing about in a fluid.

The *treatment* of wounds of the heart must be conducted upon general principles. If the patient be found in a swooning condition, a drink of cold water, with an abundance of cold air, may be allowed, and the head and shoulders should be laid low in order to promote the access of blood to the brain. If the shock be excessive, sinapisms are applied to the spine and extremities, and an injection of turpentine or ammonia given; but all internal stimulants are, if possible, avoided, lest, by favoring untoward reaction, they should increase hemorrhage and the tendency to inflammation. Protracted depression is rather to be desired than avoided. Hence the treatment, for the first two or three days, should be as much as possible of an expectant nature. Opium should be given largely to relieve pain, which is often very severe, but above all, to tranquillize the wounded organ, the tumultuous action of which cannot fail to exert an injurious influence upon the reparative process. It should be combined with aconite and acetate of lead, to augment its sedative influence and promote the coagulability of the blood. When inflammation has set up, our chief reliance must be upon the lancet, antimony, calomel, opium, mild purgatives, and revulsives to the chest, especially large blisters, with elevation of the head and shoulders. The patient must take great care of himself during convalescence and for a long time afterwards.

Wounds of the *large vessels* of the chest are sufficiently common, and are, perhaps, still more frequently fatal than those of the heart. Their symptoms and treatment require no special attention.

## CHAPTER X.

DISEASES AND INJURIES OF THE JAWS, TEETH,  
AND GUMS.

## SECT. I.—AFFECTIONS OF THE SUPERIOR MAXILLARY BONE.

THE superior maxillary bone differs from most of the other pieces of the skeleton, in having a large cavity, denominated the chamber of Highmore. This chamber, which is very diminutive in young subjects, is situated in the body of the bone, and is lined by a reflection of the mucous membrane of the nose, with the middle meatus of which it communicates by an opening, which, in the recent state, hardly equals the volume of a crow-quill. Owing to this peculiarity of structure, the diseases of the superior maxillary bone are of a much more complicated character than those of the inferior, though they are, perhaps, not any more frequent. The most important affections of the chamber of Highmore are wounds, inflammation, abscess, mucous collections, and various kinds of tumors, especially the encephaloid.

1. *Wounds*.—Wounds of the sinus may be inflicted through the cheek, the alveolar process, the roof of the mouth, or the orbit of the eye; and in their character they may be incised, punctured, or gunshot. The bleeding is always slight, and the treatment of the accident involves no particular principles. Sometimes a wound in this situation is complicated with the presence of a foreign body, which maintains irritation, and impedes the cure. A middle-aged man, a patient of Dr. Donne, of Kentucky, had the antrum perforated in May, 1840, with a small dirk-knife. The instrument entered at the orbit, wounding the eye, and breaking off in the cavity of the bone, from which it was extracted more than two years afterwards through the roof of the mouth, its situation being indicated by a black spot a short distance from the first and second molar teeth. The proper treatment, in all cases where the foreign substance is retained, is to search for, and, if possible, to extract it. The same mode of management is necessary when a tooth or fragment of bone is forced into the cavity.

2. *Inflammation*.—Inflammation of the lining membrane of the maxillary sinus is uncommon. It may be developed under the influence of various causes, of which the most frequent are external injury, suppression of the cutaneous perspiration, a syphilitic taint of the system, the inordinate use of mercury, and, above all, the irritation produced by a loose, carious, or necrosed tooth. Occasionally the disease is propagated from the mucous membrane of the nose, by mere



contiguity of structure. The principal symptoms are pain, of a fixed and severe character, a sense of weight and heat, pulsation, aching of the molar teeth, and, in violent cases, fever. The cheek is often tender on percussion, and the integuments sometimes pit on pressure. An increased discharge, of a thin, watery, and fetid nature, from the corresponding nostril, is occasionally present. The pain generally extends to the surrounding structures, as the teeth, nose, orbit, and forehead. The above symptoms, which are always less marked in the chronic than in the acute form of the malady, are not diagnostic, and the practitioner should, therefore, always institute the most thorough examination before he finally decides on their value.

It is of great importance that this disease should be early recognized and properly treated, as its tendency, when neglected or mismanaged, is to run into suppuration and other mischief. Diseased teeth, or stumps of teeth, are, of course, removed, even when it is not very apparent that they are the cause of the inflammation. If the symptoms are severe, blood is taken from the arm, and by leeches from the cheek or the alveolar process; the bowels are freely evacuated with senna and salts; and the action of the heart is still further depressed, if necessary, by the exhibition of antimony and diaphoretics, the latter of which are particularly indicated when the inflammation has been induced by cold. Fomentations and the application of steam are often beneficial in assuaging pain and relieving morbid action.

3. *Abscess*.—The formation of abscess in the antrum is denoted by an increase of the local and constitutional suffering, described as attending inflammation. The pain becomes more violent, and assumes a throbbing, pulsatory character, darting about in different directions, and being accompanied, in most cases, by a feeling of weight and tightness at the focus of the morbid action. Aching sensations are perceived in the teeth, the nose, and frontal sinuses; and there are often severe rigors alternating with flushes of heat. By and by, an erysipelatous blush appears on the cheek; the surface pits on pressure, and is exquisitely painful on the slightest touch. On raising the lip, the gum over the large grinders is found to be abnormally red and tumid, evincing the same increase of disease here as in the other situation. When the natural outlet of the sinus is not obstructed, there is often an escape of pus from the corresponding nostril, which, together with the symptoms just narrated, leaves no doubt respecting the true nature of the complaint.

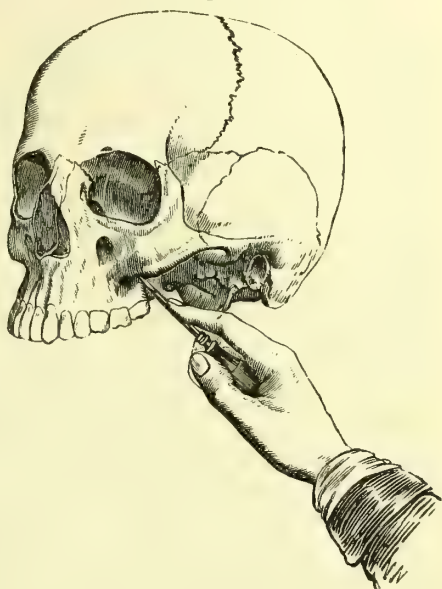
The matter in this disease is rarely abundant, except in the chronic form, when it may amount to several ounces. It is generally of a thick, cream-like consistence, of a yellowish-green color, and highly fetid, apparently from its long retention. In the more violent grades of the disorder it is often intermixed with flakes of fibrin. In chronic abscess, the lining membrane usually undergoes serious structural changes, becoming thickened, flocculent, and even ulcerated, at the same time that the walls of the antrum are expanded in every direction.

The *treatment* of abscess of the antrum is conducted on the same principles as that of abscess of the soft parts. The rule is to afford a free outlet to the pent-up fluid; if possible, before the occurrence of

serious structural change. Such a step is not neglected even when there is no material obstruction in the natural orifice of the sinus, the insufficiency of this, from its elevated, and, consequently, unfavorable position, being well known. As the abscess is frequently directly dependent upon the irritation of a decayed tooth, or as some of the teeth are apt to become involved in the disorder, the safest and most expeditious way of affording relief is to extract the affected tooth, the fang of which often projects into the sac of the abscess, and only requires removal in order to let out its contents. Should the opening thus made be inadequate, it may be easily enlarged by means of a trocar (fig. 296), or a very narrow trephine. Patency is carefully maintained until the mucous membrane has regained its normal functions; an occurrence which may often be greatly expedited by the use of mildly astringent injections, and suitable constitutional measures. The tooth usually selected is the middle grinder, especially if it be diseased. When the abscess points at the alveolar process, the puncture may be made there, but with a result much less promising of ultimate success.

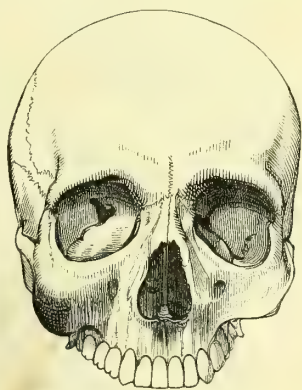
4. *Accumulations of Fluid.*—The maxillary chamber is sometimes the seat of a species of dropsy, produced by the occlusion of its natural outlet, and the consequent retention of its natural secretion. The cavity, in fact, is placed in the same condition as a mucous crypt laboring under obstruction of its orifice; the result in either case being an encysted tumor (fig. 297). The retained substance may be simply of a thin, watery character, or it may be thick and ropy like mucus, glairy and albuminous like the white of an egg, yellowish and oily, like the contents of a joint, or pale and tremulous, like jelly. Its quantity varies from a few drachms to a number of ounces, according to the duration and activity of the disease. When very abundant, as it sometimes, though rarely, is, it expands the walls of the antrum in every

Fig. 296.



Perforation of the antrum.

Fig. 297.



Dropsy of the antrum.

direction, and thus causes the most hideous deformity of the corresponding side of the face. The cheek bulges out like an immense protuberance, the nose is thrown out of shape, the eye protrudes from its socket, the anterior naris is completely occluded, and there is great depression of the palate. The tumor fluctuates faintly under pressure, the teeth become loose, and the skin has a livid, attenuated appearance. The disease is slow in its progress, and attended with hardly any pain; the general health remaining good. In the worst cases, mastication, deglutition, speech, and respiration are interfered with. The affection is occasionally witnessed in young subjects, but is most frequent in middle age.

It is difficult to distinguish this disease from carcinomatous and other formations of the antrum. Its best diagnostic characters, perhaps, are the tardiness of its progress, the absence of pain, the want of enlargement of the neighboring lymphatic ganglions, and the preservation of the general health. In case of doubt, the exploring needle is employed, the swelling being carefully punctured at different points of its extent.

The *treatment* is based upon the same principles as that of abscess, evacuation of the contents of the chamber being effected at the most dependent portion of the tumor. The palate bulging, the opening is made there; or a decayed tooth is extracted, and the fluid is allowed to drain off along the resulting channel, widened, if necessary, by artificial means. Gradually the osseous cyst contracts, and reaccumulation being prevented, it is eventually obliterated, the process being often advantageously expedited by the use of mildly astringent injections. When the cure is very tardy, in consequence of the great bulk of the tumor, it may be well to cut away a portion of its outer wall, care being taken not to injure the integuments of the face.

5. *Polyps*.—It is rare to meet with polyps of the maxillary sinus. A great variety of morbid growths, having scarcely any common points of resemblance, have been described under this name, much to the detriment of sound pathology and practice. Perhaps the best specimen of a polyp of the antrum, and one which I have certainly more than once seen in my operations on the upper jaw, is the sarcomatous, as it is vaguely termed. It is not easy, however, to describe this variety of tumor, so diversified and multiform are its component elements. Its most ordinary character is the fibrous, in which, as the name implies, there is a predominance of the fibrous structure, although there is often, if, indeed, not constantly, an intermixture of other elements, especially the cartilaginous; small cysts, cells, or cavities, containing various kinds of fluids, as serous, glairy, and sanguineous, are sometimes interspersed through their substance, and serve to give them a compound character. Few vessels are apparent in their structure, and hence they seldom attain any great bulk, or advance with much rapidity. For the same reason they do not bleed much when ulceration takes place, or when we attempt their removal. The color of these tumors varies; some are pink, some livid, some white and opaque, like an oyster.

Most of these tumors spring originally from the mucous membrane



of the sinus; but occasionally their development begins in the proper substance of the bone, which, in this case, is gradually broken down and disintegrated, and ultimately lost in the new product. Their volume, though generally small, sometimes equals that of a fist; they manifest no malignant tendency, and rarely return after extirpation. Middle-aged persons are their most frequent subjects.

Polyps of the antrum are distinguished from encephaloid and other carcinomatous formations of the upper jaw, first, by the tardiness of their growth; secondly, by their globular, ovoidal, or pyramidal shape; thirdly, by their circumscribed character, or indisposition to ramify through the surrounding parts; fourthly, by their firm, unyielding consistence; fifthly, by their painlessness; and, lastly, by the absence of contamination of the neighboring lymphatic ganglions. There is, moreover, little tendency in such tumors to ulceration; the mucous membrane of the mouth retains its fluid appearance; and there is much less sanguinolent discharge from the nose than in encephaloid. The general health is not deteriorated, and the countenance is free from that sallow and dejected expression which forms so striking and characteristic a feature in malignant disease.

A polyp of the antrum may occasionally be approached by the mouth, the outer wall of the cavity being opened just above the roots of the teeth. When the wall is very thin and soft, the operation may be performed with the knife, but when the reverse is the case it may be necessary, in addition, to use a gouge and mallet. The cheek is, of course, detached from the bone for some distance as a preliminary measure. I have, on several occasions, removed polypoid tumors from the antrum in this way with very satisfactory results, and the plan should always, if possible, be adopted in preference to any other, as it is unattended with disfigurement of the face. When the morbid growth is uncommonly large, it will be necessary, as a general rule, to approach it through the cheek, as in the extirpation of malignant tumors, presently to be mentioned. Little hemorrhage usually accompanies such operations.

6. *Vascular Tumors*.—A tumor, having all the properties of an anastomotic aneurism, has occasionally been seen in the maxillary sinus. It is difficult to determine whether it takes its rise in the mucous membrane of the sinus, or in its bony walls. However this may be, it appears to consist essentially in an enlargement of the branches of the internal maxillary artery, which interlace with each other in every conceivable manner, and thus form a tumor of an erectile character, similar to a nevus of the face. As the affection progresses, the walls of the antrum are absorbed, and the morbid growth becomes subcutaneous, feeling like a soft, spongy mass, and exhibiting a bluish, purple, or modena color. Its pulsation, which is synchronous with the contraction of the left ventricle, is very distinct under the finger, and can generally be seen at some distance. When the tumor is very large, it encroaches upon the eye, nose, and mouth, and is productive of great deformity.

The prominent *symptoms* of the disease are, its steady increase, its tendency to encroach upon the surrounding parts, its soft, spongy consistence, its pulsatory movements, and the livid discoloration of its

surface, both external and internal. The attendant pain is usually slight, and the general health is seldom impaired, until after the establishment of nasal hemorrhage, which is sure to set in sooner or later, and which is often profuse and draining in its effects.

If the tumor be seen early, or, rather, if it be recognized before it has attained any considerable bulk, the proper procedure would be to expose it by a careful dissection, and effect its destruction with the actual cautery, the Vienna paste, or acid nitrate of mercury. Perhaps a portion of the growth might be constricted with the ligature, as in the operation for the radical cure of hemorrhoids. When it has attained a large size, ligation of the common carotid artery, as proposed and practised by the late Professor Pattison, may be tried, although, it must be confessed, with but a faint prospect of success.

7. *Encephaloid*.—By far the most frequent, as well as the most formidable disease of the chamber of Highmore, is encephaloid, osteocephaloma, or soft cancer, which occurs here, as elsewhere, in both sexes, in all classes of individuals, and at all periods of life. I have witnessed it in children under five years, in young adults, at middle life, in old age, and in decrepitude. It is, however, undoubtedly most common between the twentieth and fortieth years. It is not known what influence, if any, occupation, temperament, climate, and other circumstances exert upon the development of this disease. In every instance of it that has fallen under my observation, it arose without any obvious cause.

The malady usually begins in the cavity of the antrum, in connection with the mucous membrane. Occasionally it takes its rise in the cancellated structure of the bone, in the socket of one of the molar teeth, in the gum, or in the periosteum. In the first case, it generally progresses until it fills up the whole sinus, after which it encroaches upon the bony parietes of the cavity, pushing them out in every direction, and thereby pressing them against the surrounding structures. As the external wall is extremely thin, in fact, a mere shell, in the natural state, the morbid growth commonly advances more rapidly in this direction than in any other, forming thus, frequently at an early stage, quite a large tumor on the cheek. By and by, as it proceeds in its development, it extends towards the nostril, partially, and sometimes completely, occluding the corresponding cavity; upwards towards the floor of the orbit, compressing and ultimately protruding the ball of the eye; downwards towards the palate, displacing the tongue, and diminishing the mouth; and backwards towards the fauces, impeding mastication, deglutition, speech, and respiration. At this stage of the disease, the countenance is most hideously disfigured, and the patient is an object well calculated to excite commiseration.

The integuments and mucous membrane are generally sound in the earlier stages of the complaint; but after a certain period, varying from several months to a year, they begin to assume a livid and congested appearance, and at length yield to ulcerative action. The consequence is a fungating and rapidly spreading sore, the seat of a thin, sanious, muco-purulent, or sanguinolent discharge, very abundant, excessively fetid, and highly irritating. Pure blood often proceeds

from it; sometimes very small in quantity, at other times so copious as rapidly to undermine the strength, and bring on hectic fever, with exhausting night-sweats.

In the latter stages of the disease, sometimes before, but generally not until after ulceration has set in, the lymphatic ganglions of the temple, behind the ear, and under the jaw, become enlarged and contaminated, and finally give way from over-distension. The countenance assumes a peculiar cadaverous expression; the patient rapidly loses flesh and strength; colliquative diarrhœa supervenes; the pain is excessive; and death finally occurs from exhaustion. The progress of the malady is variable; sometimes very rapid, at other times quite tardy. I have seen death produced by it in less than six months from its commencement; and, on the other hand, I have met with cases in which the fatal event did not take place under several years. My experience is that the affection is usually more rapid here, as elsewhere, in children and youths than in the middle aged and old.

When such a tumor is inspected after death, or removal, it is found to exhibit all the characteristics of encephaloid formations generally. That portion which occupies the antrum is commonly quite soft and pulpy, resembling, at least faintly, both in color and consistence, a section of the brain. The osseous structure is broken down and disorganized, quite vascular, and so soft as to be easily cut. In some places, and in some specimens, it is entirely, or nearly entirely, absorbed; while in others it is replaced by fibro-cartilage, or cartilage, intermixed with spicules and scales, remnants of the original tissues. In the majority of cases, the morbid growth is remarkably vascular, being pervaded in every direction by large vessels, the walls of which are exceedingly brittle, and, therefore, liable to yield under the slightest impulse. It is owing to this circumstance that these tumors frequently attain such an enormous bulk, and that, when ulceration sets in, they are so liable to fungate and bleed.

The *recognition* of encephaloid disease of the superior jaw, however commencing, is usually not difficult. The rapid growth of the tumor, its steady encroachment upon the adjacent parts, its soft and elastic feel, the livid aspect of its buccal portion, and its sharp, darting pains, readily distinguish it from all other formations of this division of the skeleton. In the latter stages of the affection, the fungous character of the ulcer, and the sanious, sanguinolent, and bloody discharges, together with the sallow and cadaverous state of the countenance, and the enlargement of the neighboring lymphatic ganglions, leave no doubt about its real nature. Important information will also be furnished by the history of the case, and by the fact that encephaloid occurs at all periods of life, while some of the other morbid growths of this region are seen only at certain ages.

When any doubt exists respecting the character of the tumor, no objection lies against the use of the exploring needle, which will at once inform us as to the consistence of the morbid product, and the nature of its contents. If it be encysted, an escape of serum, or mucosanguineous fluid, will afford the necessary intelligence, and enable us to shape our course accordingly. Should encephaloid matter be pre-



sent, the smallest particle will, if subjected to the microscope, reveal the characteristic cancer-cell.

Encephaloid disease of the jaw seldom co-exists with malignant disease in other parts of the body. The affection, in fact, in the great majority of instances, is more local in its character than when it invades the cellular tissue, eye, and glandular organs. It is, doubtless, owing to this circumstance that excision of the disease, especially in its early stage, is occasionally successful; though, in general, the prognosis is most unfavorable, and yet this is the only resource the surgeon has at his command.

8. *Scirrhus*.—Scirrhus of the upper jaw is extremely rare; I have never seen an instance of it, and what is usually described as such is probably nothing but encephaloid disease. If it should ever occur here, it would be likely to show itself in advanced life, as a hard, firm, solid tumor, slow in its progress, and characterized by sharp, lancinating pain. It would not be likely to attain as great a bulk as soft cancer; nor would it be so liable to fungate and bleed. Of colloid and melanosis of the upper jaw, we are entirely ignorant.

9. *Exostosis*.—The superior maxilla is one of those pieces of the skeleton which are liable to exostosis, that is, a genuine osseous tumor. The morbid growth, varying infinitely in regard to its size and form, is most common in old and middle-aged subjects; it may appear upon any part of the bone, and, gradually augmenting in volume, may at length involve it in its entire extent. It is strictly a local affection, the result generally of external violence, or of a syphilitic taint of the system; and rarely, if ever, degenerates into malignant disease.

An exostosis is easily recognized. Its chief peculiarities are, its excessive hardness, its slow growth, its freedom from pain, the absence of disease in the surrounding structures, and the unimpaired state of the general health. There is no discharge of blood, or muco-purulent matter, no tendency to ulceration, no alteration, at least not for a long time, in the skin of the face, or in the mucous membrane of the mouth; the principal inconvenience is from the size of the morbid growth, which is occasionally enormous, and from its consequent interference with the functions of the adjacent parts. When doubt exists, a small exploring needle, introduced at various points of the tumor, will at once decide the question.

Little is to be accomplished in this disease by medical treatment. When the tumor is young and small, the external and internal use of iodine may be serviceable in diminishing, and even in eradicating it. A mild mercurial course, conjoined with the internal exhibition of iodide of potassium, is indicated when it is dependent upon a syphilitic taint of the system. A growth of this kind has been known to drop off spontaneously. But such an event is not to be looked for, nor, as before stated, is much to be expected from therapeutic agents. In general, nothing short of extirpation will answer, and this, fortunately, is usually readily accomplished by the ordinary means.

10. *Hypertrophy*.—A very singular enlargement of the superior jaw, constituting a species of partial hypertrophy, and depending upon the irritation of an inverted tooth, is occasionally met with. An instance

of the kind, the only one I have seen, fell under my observation in 1843, in a young lady, aged twenty-one. The enlargement, which had been first noticed two years and a half previously, and which was about the volume of a large hickory-nut, occupied the alveolar process of the left jaw, and was of a hard, firm consistence, free from pain and soreness, unaccompanied by disease of the gum, or derangement of the general health, and formed at the expense mainly of the outer plate of the bone. Upon sawing into the tumor, it was found to be occupied by a cuspid tooth, a little smaller than natural, but well grown, with the crown reversed, or directed upwards towards the antrum of Highmore. The parts soon healed, and with hardly any defect, save what resulted from the extraction of the canine tooth, which was deemed necessary as a preliminary step.

11. *Encysted Tumors.*--Very recently, I had at the College Clinic an old man, brought there by Dr. Piper, of this city, on account of an encysted tumor of the upper jaw, evidently formed in the areolar structure, just above the lateral incisor and cuspid teeth. It was about the volume of a lime, and distinctly fluctuated under pressure, its anterior wall crackling like parchment. Its contents were of a serous character. The tumor being opened with a stout knife, its secreting surface was freely touched with chromic acid, a tent being afterwards introduced to keep up the irritation. Healthy granulations soon sprung up, and in less than two months the cavity was completely obliterated.

#### EXCISION OF THE UPPER JAW.

Excision of the upper jaw is required chiefly in malignant disease, and under such circumstances it may be necessary to remove, at the same time, portions of the malar, turbinated, ethmoid, and sphenoid bones, which are often involved in the morbid action. A part of this bone, it would seem, was removed by Acoluthus as early as 1693; but the honor of first extirpating the whole of it is due to the late Dr. Jameson, of Baltimore, who achieved the enterprise successfully in 1820. An account of the case is contained in the fourth volume of the American Medical Recorder, and is well worthy of an attentive perusal. Since then the operation has been repeatedly executed by American surgeons, among whom Stevens, Mott, McClellan, Mussey, Pancoast, Mütter, and the two Warrens, deserve special mention. I have performed it a number of times.

In performing the operation, the patient should always be placed recumbent, especially if the tumor is of considerable bulk, and a good deal of time is required to effect its removal. A broad and rather thin pillow should be put under the head and shoulders, and the face should be inclined towards the opposite side. Very few persons, whatever may be their courage and fortitude, can bear the shock and fatigue of an undertaking of such magnitude in the sitting posture. This precaution is the more necessary if chloroform be given, as I always do in such cases. I am aware that objections have been urged against the administration of this remedy in operations on the mouth,

but without, I believe, any just reason. Be this as it may, I have employed this agent, ever since its introduction into practice, in all the amputations, both of the upper and lower jaw, that have fallen under my observation, and I have certainly, thus far, had no cause to regret it. The mouth can always be easily cleared of blood, even if the patient is unconscious, with the finger, or a sponge-mop.

I have never found it necessary, in any of my operations on the upper jaw, to secure the carotid artery, as a means of preventing hemorrhage. Indeed, it is surprising that such a procedure should ever have been recommended, much less practised, by any one. My experience is that there are no organs in the body, of the same extent, in their natural and diseased condition, the removal of which is attended with so little hemorrhage. No skilful surgeon now even employs compression of the carotid artery in these operations, and, as to tying that vessel as a means of security against the loss of blood, I should as leave think of ligating the femoral artery for the same purpose. Nothing, it seems to me, could be more absurd and unnecessary. The chief danger from hemorrhage is in the subcutaneous arteries, especially the facial and its branches, and these are always readily controlled by the ligature. The deep-seated arteries, involved in tumors of the upper jaw, seldom bleed much, if care be taken to keep beyond the limits of the diseased structures. If this precaution be neglected, the hemorrhage may be copious, if not exhausting. The oozing which takes place from the osseous surface, after the exsection is completed, in general speedily ceases of its own accord from the contact merely of the air; when it does not, it is usually easily arrested by compresses wet with a saturated solution of alum. The actual cautery can be required only when the vessel is entirely beyond the reach of the ligature, or when a portion of the disease has been left behind; a circumstance which should never happen in the hands of any one, as it must necessarily lead to a speedy reproduction of the tumor.

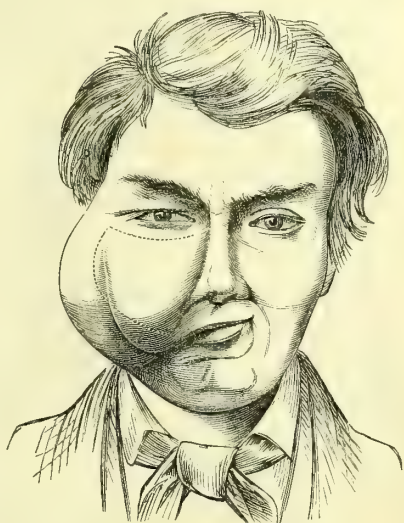
The direction, extent, and number of the incisions through the soft parts must necessarily vary with the situation and volume of the tumor. In all these respects, much must be left, in every case, to the judgment and experience of the operator. When the morbid growth is comparatively limited, and seated upon the anterior, or antero-lateral, aspect of the jaw, we shall generally be able to dispense with external incisions altogether, as our object may be readily accomplished simply by dissecting off the lip from its attachments to the bone, and holding it out of the way with a finger, or blunt hook. The surface of the tumor having thus been thoroughly denuded, the bone is attacked with the pliers, and severed fairly beyond the line of the disease. By this procedure, which is admirably adapted to the more simple forms of morbid growths, the operation is divested of much of its severity, and not followed by any deformity of the features, save what results from the caving in of the integuments.

When the tumor involves the body of the jaw, and is of considerable bulk, the plan which I usually adopt, and which has always answered my purpose most fully, is to make one long, curvilinear incision, extending across the most prominent part of the tumor, from



the commissure of the lips towards the zygomatic process of the malar bone, terminating within a few lines, half an inch, or an inch, of the external angle of the eye, according to the exigencies of the case. In this manner are formed two flaps, the upper of which is convex, and the lower concave, which are then carefully dissected up by bold and rapid strokes of the knife, and held out of the way by trustworthy assistants, who, at the same time, take care to compress the bleeding vessels. The space which this procedure affords is, in general, quite sufficient for the easy removal of the entire tumor, however large or extensive its connections. In my own cases, it has always answered the purpose most thoroughly. Should it, however, be inadequate, it can readily be increased to the requisite extent by carrying the knife horizontally along the inferior border of the orbit, as far over as the nose, as exhibited in the adjoining cut (fig. 298), from a patient, affected with encephaloid disease of the antrum, whom I recently attended with Professor Pancoast. In making the first of these incisions, the facial artery is necessarily divided, and, in the second, the superior maxillary nerve, together with many of the branches of the portio dura of the seventh pair. In consequence of the injury thus sustained, the parts supplied by these nerves remain a long time paralyzed, though ultimately the face regains, in great degree, its accustomed power and expression.

Fig. 298.



When the tumor, or enlargement, occupies the anterior and upper portion of the jaw, the external incision may extend vertically upwards by the side of the nose, from the free border of the lip to a level with the orbit of the eye. This will enable the operator to detach the wing of the nose, and to remove, if necessary, the ascending process of the jaw-bone, the lachrymal bone, the inferior turbinated bone, and even the vomer, as I have been compelled to do in two instances.

When the antrum is mainly implicated in the disease, two incisions, representing the form of an inverted L, are necessary, the vertical limb corresponding with the ascending process of the maxillary bone, and the horizontal one with the inferior border of the orbit of the eye.

Whatever may be the form and direction of the incisions, care should always be taken that they are sufficiently extensive to afford ready access to the diseased mass. Nothing can be more embarrassing, or display a greater want of judgment in the operator, than a want of room in a case of this kind.

The necessary incisions having been made, and the flaps dissected

up, the next step is to remove the tumor. As a preliminary measure, two teeth, one in front and the other behind, must be extracted, to make room for the play of the saw and other instruments. As a general rule, this part of the operation should always be performed as soon as the patient is fairly under the influence of chloroform, and, consequently, prior to the division of the soft structures. If done after that, it is liable to occasion delay and annoyance.

The separation of the jaw is generally the work of a few minutes. The limits of the disease being usually well defined, care must be taken to keep on the outside of them, for the twofold purpose of avoiding hemorrhage, and removing the whole of the morbid structures. The

Fig. 299.



Fig. 300.



Fig. 301.



best contrivance for executing this part of the operation is a pair of pliers. The surgeon should supply himself with at least three of such instruments, of different shapes and sizes (figs. 299, 300, 301), as one is rarely sufficient for the purpose. He should also have several chisels, small saws, a lenticular, and a stout scalpel, the handle of which should terminate in a steel point, that it may be used as a scraper and a cutter, as may be found expedient.

When it is designed to remove the entire jaw, the saw or pliers should successively be carried through the alveolar process in front, and the horizontal plate behind, close to the middle line, as far back as the corresponding portion of the palate bone; the mucous membrane of the roof of the mouth having been previously divided with the scalpel, to prevent it from being bruised and lacerated. Next, the instrument is to be applied to the malar bone, at or near its junction with the maxillary, and, finally, to the nasal process, which is generally divided on a level with the lower margin of the orbit. The orbital plate of the jaw bone is commonly left intact, at least in part, as it rarely participates in the morbid action. Should it do so, however, it should be cautiously removed with the chisel and knife, lest the eye and its appendages be injured. All that now remains to be done is to sever the tumor at its junction with the pterygoid process and palate bone; and here, again,

the chisel and knife will come into excellent play. The main tumor having been removed, the parts are carefully sponged, and any remnants of diseased substance that may appear are cleared away with the lenticular, gouge, and other suitable instruments.

The cavity made by the operation being carefully sponged, any vessels that may seem inclined to bleed are at once secured. It is seldom, in any case, that more than three or four ligatures will be required. To arrest the oozing of blood from the deep portion of the wound, and give support to the cheek, the osseous gap should be stuffed with patent lint, wet with a saturated solution of alum. The edges of the cutaneous wound are then approximated by the twisted suture, and a compress being applied upon the cheek, the parts are supported by a roller, passed round the head and chin in the form of a figure 8.

The *after-treatment* is strictly antiphlogistic; and, as the great danger to be apprehended is erysipelas, every means should be used to prevent its occurrence. The needles are removed at the end of the third day, when the edges of the incision will generally be found perfectly united. I have repeatedly seen wounds, eight and nine inches in length, close by the first intention after these operations. The patient soon becomes accustomed to his loss; and the function of deglutition, at first so difficult and annoying, is gradually performed with its original facility. Even the faculty of mastication is regained much more rapidly than one, unacquainted with the compensating powers of nature, might be led to suppose. The deformity of the face is often comparatively trifling; and the defect in the mouth may usually be remedied, in the more favorable cases, by artificial means. It is surprising how much, even in a short time, the cavern contracts, and how all the surrounding and associated parts accommodate themselves to their new situation.

It would be interesting to give an account of the results of the different operations that have been performed for the removal of the upper jaw for malignant and other diseases; but for such an undertaking we have, unfortunately, no precise data. When the tumor is of the encephaloid character, it may safely be assumed that it will return, sooner or later, in almost every instance, however thoroughly the abnormal structure may have been extirpated. In the non-malignant varieties, on the contrary, there is no reason to apprehend a relapse, any more than in the same class of affections in other parts of the body.

## SECT. II.—AFFECTIONS OF THE INFERIOR MAXILLARY BONE.

The lower jaw-bone is liable to various affections, of which the principal are caries, necrosis, and different kinds of tumors.

1. *Caries*.—Caries of this bone does not require any particular notice, as it is neither frequent in its occurrence, nor peculiar in its character. Various causes may induce it, as external injury, the irritation of a decayed tooth, mercurialization, or a scorbutic, strumous, or syphilitic taint of the system. Whenever it takes place, the nature of the



exciting cause should, if possible, be traced out, and the case treated accordingly.

2. *Necrosis*.—Necrosis is also uncommon, being witnessed principally as a result of profuse pyalism, especially in young and weakly persons, of a strumous temperament. Large portions of the bone, along with the corresponding teeth, are often destroyed by this cause in this country, where mercury is given with such a profuse and daring hand. I have known cases where more than one-half of the bone perished and sloughed away from the effects of salivation. The inflammation which precedes and accompanies the necrosis, frequently involves the soft parts, producing extensive mortification, and the most horrible deformity of the features. Fortunately, such cases are becoming every year less common among us, for the vile and unmeaning practice upon which they generally depend is fast falling into desuetude. One of the worst things connected with these occurrences is the permanent closure of the jaw by the inodular tissues, which are generally extremely firm, and exhibit the same tendency to contraction as the inodular tissues of a burn. As a consequence, the poor sufferer is often unable to move the bone in the slightest degree, except, perhaps, a little laterally, and has the greatest difficulty in feeding himself. I have seen many cases in which mastication was utterly impracticable, and where the food was always obliged to be chopped as finely as possible before it could be introduced into the mouth. Articulation, of course, is impeded, and, if the patient be young, his education must necessarily suffer. In a word, I know of no class of human beings who are more deserving of our commiseration and skill than this, or who have more reason to complain of the carelessness and incompetency of medical practitioners.

Necrosis is always easily distinguished by the denuded state and whitish appearance of the affected bone, by the existence of purulent discharge, and by the excessively fetid state of the breath. The part, when struck with the probe, emits a peculiar ringing sound, very different from that of a sound bone.

The *treatment* consists in attention to cleanliness and the removal of sequesters. To fulfil the first intention, free use is made of the solutions of soda and lime, along with such remedies as shall have a tendency to improve the general health. The dead bone may sometimes be withdrawn with the fingers; but, in general, it will be necessary to employ the forceps, and, it need hardly be added, that this should always be done with the greatest care and gentleness. When the sequester is very large, the operator may be compelled, as a preliminary step, to cut the gum, or even to divide the part with a saw or pair of pliers, but an external incision will seldom be required in any case, however extensive. When the whole of the lower jaw is necrosed, the proper procedure is to divide the bone at the chin, and to draw out each half separately; the knife being used wherever it may be necessary on account of the resistance of the soft structures. Where these precautions are used, and the operation is postponed until the sequestration is entirely, or at least measurably, completed, I feel satisfied that there will seldom be any need of external incisions.

The entire lower jaw, affected with necrosis, was thus removed by Dr. George McClellan in 1823.

Within the last few years, the attention of the profession has been called to a singular species of necrosis of the lower jaw dependent upon the injurious effects of the fumes of *phosphorus* in the manufacture of lucifer matches. In this country, it was first noticed by Dr. James R. Wood, who gave an account of it in the New York Journal of Medicine for May, 1856, accompanied by the history of a case in which he removed the entire lower maxillary bone for the cure of this disease. In order to produce its specific impression, it is necessary, it would seem, that the vapor should come in immediate contact with the periosteum, or the alveolar process of the bone; hence it is alleged that those only who have carious teeth are liable to suffer from it. There are, however, some pathologists who assert that the phosphorus is absorbed into the system, and that its effect upon the jaw is altogether secondary, acting very much in the same manner as mercury. However this may be, the disease is essentially inflammatory, and gradually terminates in a loss of vitality, sometimes so extensive as to involve the entire bone. Its approaches are usually slow and insidious, the parts feeling merely somewhat tender and painful, as so often happens in slight toothache. The disease, in fact, is at first quite chronic. By and by, however, it acquires new activity, and then rapidly accomplishes its work, the local and constitutional disturbance being excessive, especially if abscesses form, and the mortification extend to the soft parts. Under such circumstances, it is not uncommon for the patient to die.

The *treatment* of the disease, in its earlier stages, is the same as in periostitis from any other cause; by leeches, incisions, astringent and detergent lotions, and general antiphlogistic means. Tonics will be demanded when there is profuse suppuration, or when the mortification extends to the soft parts. In the latter case, the best topical remedy will be dilute nitric acid, acid nitrate of mercury, or nitrate of silver, with chlorinated washes.

Surgical interference is required when the dead bone has become measurably detached; it may be removed entire, or piecemeal, according to circumstances. In general, the operation may be satisfactorily performed without any external incision, even when the whole bone is involved.

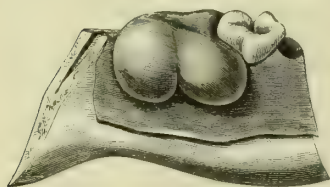
3. *Exostosis*.—Exostosis of the lower jaw is very rare. It is generally situated between the angle and symphysis of the bone, and is capable of acquiring an enormous bulk. Its cause may sometimes be traced to external injury, or to the irritation of a decayed tooth, which has occasionally been found completely encapsuled by the morbid growth. The disease is slow in its progress, and seldom productive of any other inconvenience than what results from its mechanical obstruction. The treatment is similar to that of exostosis in other parts of the body.

The lower jaw is sometimes expanded, at one particular point, into a hard, firm, solid tumor, constituting a species of local hypertrophy. The density of the affected part is occasionally equal to that of ivory.

A few years ago, Dr. Pinkey, of the United States Navy, showed me a piece of the body of the inferior maxillary bone, which he had removed for a disease of this kind from a man at Lima, and which was so hard that he found it almost impossible to divide it with the saw. An account of the cure has been published in the twelfth volume of the *American Journal of the Medical Sciences*.

4. *Epulis*.—One of the most common affections of this bone is epulis, of which the annexed drawing (fig. 302), from one of my

Fig. 302.



Epulis, in its earlier stages.

patients, affords a good illustration in its earlier stages. It consists, originally, of a small, fleshy-looking tubercle, which, as its name implies, projects from the gums, though it is doubtful whether it ever originates there. From what I have seen of it, I am inclined to believe that it generally, if not always, begins in the socket of one of the teeth, usually one of the molar, from which it gradually extends upwards until, in many cases, it

forms a growth of considerable volume. It is of a dense, firm consistence, of a florid color, and of a peculiar fibrous structure. Its shape is irregularly rounded, somewhat like a mushroom, its point of attachment being usually much smaller than its free extremity. When first noticed, it has generally the appearance of a little excrescence, situated at the side of one of the teeth, which, in time, becomes loose, and ultimately drops out. During its progress, which is commonly rapid and painful, it extends in different directions, forming a mass which fills up a considerable portion of the mouth, and which interferes essentially with mastication, articulation, and even deglutition and respiration.

It is difficult, in the present state of the science, to classify this morbid growth. Most writers seem to regard it as belonging to the canceroid varieties of disease, and it certainly approaches these affections more nearly, in its progress, symptoms, and reproductive tendencies, than any other with which we are acquainted. In all the cases that have fallen under my observation, and their number has been considerable, the repullulating disposition has been most remarkable. As to its exciting causes, absolutely nothing is known. It occurs in both sexes, and at all periods of life, though young persons appear to be most subject to it. In cases of long-standing, the surface of the tumor ulcerates, and becomes the seat of severe pain, and of a fetid, sanguinolent discharge. The neighboring lymphatic ganglions enlarge, and the constitution evinces signs of contamination. The time at which the disease destroys life varies from twelve months to three years.

The only remedy for this affection is early and effectual excision, not of the tumor, or of the parts from which it grows, but of the portion of the bone in which it has its origin. I am satisfied that it is worse than useless to temporize with such a malady; the only way is to deal it at once an effectual blow by sawing out a piece of the jaw,



embracing its entire thickness, and reaching some distance beyond the limits of the morbid mass. I have never known a case in which any other procedure did the least good. In treating epulis, we should not lose sight of the fact that it is an affection, not so much of the gums as of the jaw-bone; and, therefore, anything short of the removal of this, at the site of the disease, is an absurdity.

5. *Cystic Disease*.—The cystic tumor of the lower jaw is uncommon, and altogether devoid of malignancy. Its ordinary site is the alveolar process, where it may attain the volume of a hen's egg, or even of a large orange. It is composed of a distinct cyst, of a fibrous texture, thin, and transparent, or slightly opaque, and is occupied by a serous, sanguinolent, or glairy, mucilaginous fluid. Sometimes, though rarely, there are several such sacs, either closely connected together, or separated by an osseous septum. The bone around the tumor is expanded into a thin, elastic, crackling, parchment-like shell, and is easily penetrated by a sharp instrument, the puncture giving vent to the characteristic contents of the cyst. This, in fact, is the best diagnostic sign of the morbid growth. The disease is always tardy in its progress, and manifests no disposition to extend among the adjacent structures. The general health remains unaffected. When any doubt exists as to the real nature of the case, recourse should be had to the exploring needle, which will usually at once dispel it.

It is seldom that this tumor requires removal of the affected bone. In general, it will suffice to puncture it occasionally with a small trocar, to evacuate its contents, the escape of which is often followed by the rapid contraction and ultimate obliteration of the sac. Something, too, may be done, in such cases, by graduated compression. When there is a strong tendency to reaccumulation, a large opening may be made, and a tent inserted; or the necessary inflammation may be provoked by injections of weak solutions of iodine. It is only in old and intractable cases that excision of the bone, at the site of the disease, will be likely to be required.

The disease to which writers have usually applied the vague and unmeaning terms *osteo-sarcoma*, and *spina-ventosa*, is, in general, merely an exaggerated form of the cystic tumor, just described. It is by far the most common of the benign formations of the lower jaw. Appearing at all periods of life, it is most frequent in young adults, and is capable of acquiring an immense magnitude. Several instances have fallen under my observation in which its volume was so great as to cause the most hideous and disgusting deformity. It is always slow in its growth, is free from pain, never affects the constitution, and does not return after extirpation. The most common site of the disease is the body of the bone, but cases occur in which nearly the whole jaw is involved. The surface of the tumor is generally lobulated, and of unequal consistence, some parts being very hard and firm, others soft and fluctuating. The subcutaneous veins are rarely much enlarged, and there is no contamination of the neighboring lymphatic ganglions. When the tumor is very voluminous, it may encroach seriously upon the mouth and throat, interrupting speech, mastication, and deglutition; but, commonly, it enlarges mostly at the

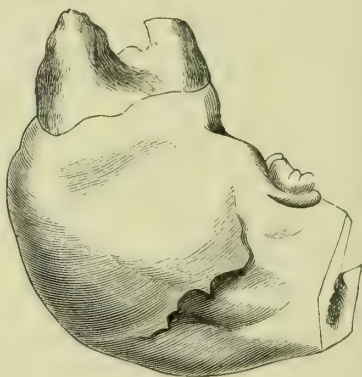
expense of the cheek, which is often frightfully distorted in consequence. The external appearances of this form of tumor are well shown in the annexed drawing (fig. 303), from a private patient, a young man of nineteen.

Examined with reference to its *structure*, the disease in question is found to be made up essentially of cells, filled with various kinds of fluid, as serous, glairy, sanguineous, and purulent, surrounded and traversed by osseous spicules, and fibrous, fibro-cartilaginous, and cartilaginous septa. The cavities vary very much in size and figure, and it

Fig. 303.



Fig. 304.



often happens that several communicate with each other. The compact structure of the bone is generally absorbed, or softened and broken up; and, occasionally, the greater portion of it is converted into a hollow shell, separated into different compartments, and occupied by different kinds of fluids. The adjoining cut (fig. 304), exhibits an enormous cystic tumor of the lower jaw, which I removed, some years ago, from a man upwards of forty years of age. It had been growing for sixteen years.

The *diagnosis* of this disease cannot be mistaken. The tardiness of its development, its unequal consistence, its fluctuating feel, and its outward growth, together with the absence of local and general contamination, are sufficient to distinguish it from all other affections of the jaw. In cases of uncertainty the exploring needle is employed. Sometimes the tumor, especially when composed of large cavities, sounds, on percussion, like a dice-box; a noise which is never heard in carcinoma.

Relief is afforded by excision of the diseased mass; and it is here, more particularly, that modern surgery has achieved some of its proudest triumphs. Tumors of enormous volume, and involving nearly the whole of the jaw, have been removed, again and again, successfully; and such undertakings may always be attempted the more cheerfully because of our positive conviction that there will be no repullulation.

6. *Hematoid Tumors*.—There is a peculiar tumor of the lower jaw,

which, from the nature of its structure, deserves to be designated by the term hematoid, as most expressive of its true character. I have seen only one case of it, a brief history of which will afford a sufficiently accurate idea of its anatomy, symptoms, and progress. The patient was a man, aged thirty-five, and the affection had been first noticed about three years before I saw him, in October, 1844. It made its appearance in the form of a hard, solid tubercle, not larger than a hazelnut, on the left side of the jaw, just behind the cuspid tooth. Its progress was very slow for a long time, but at length it began to increase with considerable rapidity, and became the seat of a constant, dull, aching pain. At the time of my examination, the tumor extended from the middle of the large grinder on the left side to the lateral incisor on the right, bulging forwards in such a manner as to cause considerable deformity of the chin. The corresponding teeth inclined backwards and inwards, and were so loose as to be unfit for mastication. The gum was abnormally red, and somewhat hypertrophied, but otherwise perfectly sound. There was no enlargement of the neighboring lymphatic ganglions, and the general health was good.

The tumor was found, after removal, to be about the volume of a medium-sized orange, and to consist of a mere osseous shell, without any vestige of cancellated structure. It was occupied by three red, solid coagula, the largest of which did not exceed the volume of a pigeon's egg. The cavity was only partially filled by the clotted blood, which adhered to the inner surface of the bony wall, and exhibited distinct traces of organization. The man promptly recovered after the operation, and has ever since remained well.

7. *Encephaloid*.—The only form of carcinoma of the lower jaw worthy of notice is encephaloid. The malady may occur here, as elsewhere, at all periods of life, but it is much more frequent in childhood and adolescence than in middle age and decrepitude. Indeed, the very worst cases of it that I have ever witnessed took place before the tenth year, and ran their course with a rapidity truly frightful. Most of the subjects of the disease perish within the first twelve months from the commencement of the attack; and, if an attempt be made to relieve them by operation, however early performed, the disease is sure to return in a very short time, either at the cicatrice or in the adjacent structures, especially the lymphatic ganglions. As the symptoms, diagnosis, and prognosis of encephaloid of the lower jaw do not differ, in any respect, from those of encephaloid of the upper jaw, any further account of it here would be useless.

8. *Deformity*.—A very unseemly deformity of the lower jaw is occasionally produced by an elongated condition of it; it is generally caused by the dragging exerted upon it by the vicious cicatrice of a burn, or by the pressure of some tumor, but instances occur in which it is congenital. The elongation is generally, if not always, associated with a peculiar oblique or horizontal direction of the bone. Besides the disfigurement which it occasions, such a defect is necessarily attended with more or less inconvenience in mastication, and in the retention of the saliva. For the cure of this deformity, an ingenious



operation was devised by the late Dr. Hullihen, of Virginia, consisting in the excision of a V-shaped portion of the bone on each side; and in one case in which he performed the operation, the result was most gratifying, although the distortion had been unusually great.

9. *Anchylosis, or Immobility of the Jaw.*—This distressing affection, which may be produced in a variety of ways, may exist in such a degree as to render the patient entirely unable to open his mouth or to masticate his food. The most common cause, according to my observation, is profuse ptyalism, followed by gangrene of the cheeks, lips, and jaw, and the formation of a firm, dense, unyielding inodular tissue, by which the lower jaw is closely and tightly pressed against the upper. Such an occurrence used to be extremely frequent in our Southwestern States, during the prevalence of the calomel practice, as it was termed, but is now, fortunately, rapidly diminishing. Children, of a delicate, strumous constitution, worn out by the conjoint influence of mercury and scarlatina, measles, or typhoid fever, are its most common victims; but I have also seen many cases of it in adults and elderly subjects. In the worst cases, there is always extensive perforation of the cheeks, permitting a constant escape of the saliva, and inducing the most disgusting disfigurement.

Secondly, the affection may depend upon ankylosis of the temporo-maxillary joints, in consequence of injury, as a severe sprain or concussion, or arthritic inflammation, leading to a deposition of plastic matter, and the conversion of this substance into cellulo-fibrous, cartilaginous, or osseous tissue. I have met with quite a number of such cases; several in very young subjects.

Thirdly, the immobility is occasionally produced by a kind of osseous bridge, extending from the lower to the upper jaw, or from the lower jaw to the temporal bone. Such an occurrence, however, is uncommon, and is chiefly met with in persons who have suffered from chronic articular arthritis.

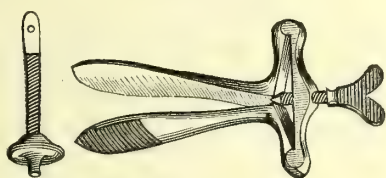
Finally, immobility of the jaw may be caused by the pressure of a neighboring tumor, especially if it occupy the parotid region, so as to make a direct impression upon the temporo-maxillary joint.

However induced, the effect is not only inconvenient, seriously interfering with mastication and articulation, but it is often followed especially if it occur early in life, by a stunted development of the jaw, exhibiting itself in marked shortening of the chin, and an oblique direction of the front teeth. When complicated with perforation of the cheek and destruction of the lips, the patient has little or no control over his saliva, and is so horribly deformed as to render him an object at once of the deepest disgust and the warmest sympathy.

The *treatment* of this affection must depend upon the nature and situation of the exciting cause. When the difficulty is in the joint, occasioned by the formation of cellulo-fibrous adhesions, the only thing that can be done is to break up the adhesions, upon the same principle as in ankylosis of any other joint. For this purpose, the patient being thoroughly influenced by chloroform, the jaw is forcibly depressed, either by a wedge made of cedar wood, or by the instrument

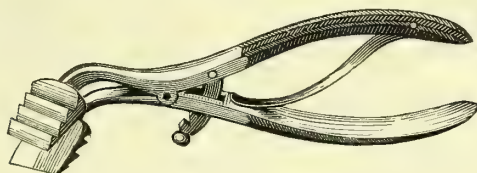
sketched in the adjoining cut (fig. 305), and depicted by Scultetus, in his well known work, the *Armentarium Chirurgicum*, but re-introduced to the notice of the profession by Dr. Mott. It is constructed, as will be perceived, on the lever and screw principle, and may be employed with great advantage in all cases of ankylosis of the jaw, not only for breaking up the adhesions within the joint, but also for maintaining the separation afterwards. Owing to the remarkable tendency which the parts have to reunite, the instrument must be daily used, for a number of hours, for many months, if not for several years. Meanwhile, sorbefacient lotions should frequently be rubbed over the joints, and every precaution taken to keep down inflammation.

Fig. 305.



The annexed sketch (fig. 306) exhibits an instrument, which, as a

Fig. 306.



mere lever for separating the jaw, and breaking up morbid adhesions, is superior to that of Scultetus, which it closely resembles in its mode of action.

When the immobility depends upon the presence of inodular tissue, the proper remedy is excision of the offending substance, an operation which is both tedious, painful, and bloody, and, unfortunately, not often followed by any but the most transient relief, owing to the tendency in the parts to reproduce the adhesions, however carefully and thoroughly they may have been removed. There is the same remarkable disposition in these cases to the contraction and regeneration of the inodular tissue as in cases of burns and scalds. During my residence in Kentucky, I had a large share of such cases, and, although I never failed to make the most thorough work, not unfrequently repeating the operation several times at intervals of a few months, it is my duty to state that few of them were permanently relieved. After the excision is effected, the patient must make constant use of the wedge, wearing it for months and years, so as to counteract the tendency to re-closure. Any pieces of dead bone, and loose, or ill-placed teeth that may be present, should always be removed prior to the operation upon the soft parts.

Immobility of the jaw, caused by the formation of an osseous bridge, might possibly be remedied by the removal of the adventitious substance, by means of the saw and pliers. The great difficulty, however, in such an event, is the obscurity of the diagnosis.

When the closure is of long standing, it occasionally becomes necessary to divide the masseter muscles, as they are often found, when this is the case, to be permanently contracted. The operation, performed, of course, subcutaneously, requires some care, lest important vessels should be divided.

The gap in the cheek, left by salivation, and so often accompanying

Fig. 307.



Fig. 308.



closure of the jaw, may be filled up by a flap borrowed from the neighboring integuments, and carefully stitched in place. The adjoining sketches (figs. 307, 308), exhibit the manner of performing the operation.

#### EXCISION OF THE LOWER JAW.

Excision of the lower jaw has, of late, become rather a frequent operation, and it is, therefore, very important that surgeons should have accurate ideas respecting the best mode of executing it. The bone may be removed entire, or it may be divided at its middle, and disarticulated at one joint, or, lastly, a considerable portion may be cut away at its centre, body, or ramus. The first attempt at amputation of the lower jaw was made by Dr. W. H. Deadrick, of Tennessee, in 1810, upon a lad fourteen years of age. The tumor was of a cartilaginous structure, and occupied the left side of the bone, filling nearly the whole of the mouth, and causing great difficulty in swallowing, and even, at times, in breathing. An incision was commenced under the zygomatic process, and carried across the tumor, in the direction of the jaw, to nearly an inch beyond the middle of the chin. From the centre of this, and, consequently, at a right angle with it, another incision was extended a short distance down the neck. The flaps thus marked off being separated from the morbid growth, the bone was sawed off just in front of the ramus and at the centre of the chin. The wound was united in the usual manner, and the boy



had a speedy recovery ; being found perfectly well thirteen years after the operation. In 1823, Dr. Mott excised nearly the whole of the inferior jaw on one side ; and eighteen months after he removed all that portion of the bone which is included between the right temporo-maxillary joint and the bicuspid tooth on the left side. This, so far as I am aware, was the first case in which exarticulation of this bone was effected in the United States.

The operation is conducted upon the same general principles as excision of the upper jaw ; the patient is placed in a similar position, and is brought fully under the influence of chloroform. The external incisions are made in such a manner as to avoid the unsightly appearance resulting from a large and exposed scar. For this purpose, when it is designed to remove one-half of the bone at its articulation, the knife should, as a general rule, be carried along its base, from the zygomatic process, about three-quarters of an inch in front of the ear, to the chin, and thence some distance up the median line, or even as high up as the red margin of the lip. When the tumor is of immense size, two incisions are sometimes required, so as to include an elliptical portion of the soft parts ; but, unless this is the case, or the skin is seriously involved in the disease, not a particle of integument should be sacrificed ; for during the healing process there is usually inordinate contraction, and hence, if this precaution be neglected, great deformity may be the consequence. By making the perpendicular incision in front of the ear, there will be little danger of wounding the temporal or external carotid artery, and the trunk of the portio dura. Sometimes, as when the disarticulation is effected with difficulty, a short horizontal incision, just below the zygomatic process, will be advantageous ; but, in general, this is unnecessary. The duct of Steno should always be avoided, as it readily may be by being careful not to carry the knife too high up, or too far forwards.

When the alveolar process alone is involved, it has been recommended that the base of the bone should be left intact, on the ground that it would serve to give support to the soft parts, and become the nucleus of a new deposit. It has even been insisted upon that, in such a case, extirpation could be easily and safely effected without any external incision, simply by detaching the lip or cheek from the jaw, and holding it out of the way during the division of the bone. Such a procedure cannot be too pointedly condemned ; it does the work only half, and is sure to be speedily followed by a recurrence of the disease.

When the operation involves the removal of the jaw at the joint, the best plan is to expose the tumor as rapidly and carefully as possible, and then saw the bone at the anterior limits of the morbid mass. This greatly expedites not only the process of disarticulation, but the separation of the jaw from its muscular and mucous connections, as it enables the operator, by seizing its anterior extremity, to move the bone in any direction he pleases. Convenient saws for dividing the bone are represented in the annexed sketches (figs. 309, 310).

One of the most important circumstances to be observed in excision of the lower jaw, is to keep in close contact with the morbid structure, and yet sufficiently away from it to prevent any portion of

Fig. 309.



Fig. 310.



it from being left behind. By attention to this rule, which I regard as one of paramount importance, two great ends are attained, namely, the easy removal of the tumor by a neat and rapid dissection, and the avoidance of hemorrhage. Cutting into the tumor is almost sure to be followed by the division of large vessels, which do not fail to bleed profusely, unless checked by compression, until the operation is completed. Besides, chipping off a piece here and another there generally necessitates a tedious after-section, alike painful to the patient, and annoying to the operator.

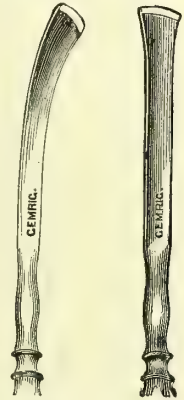
Another important rule, in these operations, is to work as much as possible with the handle instead of the edge and point of the knife, especially in detaching the bone from the soft structures. Whenever it can be done a portion of the periosteum should be saved, and there are few cases, except in the malignant forms of tumor, in which this membrane is so thoroughly involved in the disease as to render this impracticable. The part thus rescued is of great importance afterwards in filling up the void produced by the removal of the bone, at the same time that it prevents undue injury to the other soft structures.

One of the great difficulties connected with the excision of the lower jaw is the liberation of the coronoid and condyloid processes. The instrument which has always, heretofore, been employed for this purpose is the knife, or the knife and saw. The fibres of the temporal muscle, embracing the coronoid process on every side, are directed to be cut close to their attachments, or, instead of this, the process is sawn through at its base; the structures of the temporo-maxillary articulation are always divided with the extremity of the knife, entered at any point that may be most convenient. Now, it has always appeared to me that this mode of procedure should, if possible, be avoided, as it is apt to be followed by serious hemorrhage, and by injury of important nerves. This is especially the case with regard to the separation of the condyle, lying, as it does, in close and intimate relation with the internal maxillary artery, which must necessarily be endangered by the knife in this stage of the operation. A wound of this vessel, just as the operation is about to be finished, is an embarrassing circumstance, from the difficulty of applying a ligature, and is liable to be accompanied by copious hemorrhage. The coronoid process, although it projects up some distance into the zygomatic fossa, is separated with less difficulty, and, as it lies anterior to the maxillary artery, there is little danger of interfering with this vessel. Still, a

pretty smart hemorrhage occasionally results from the division, simply, of the little arteries of the temporal muscle.

To obviate this danger, as well as to expedite the process of disarticulation, usually, and, in truth, very justly regarded, in the ordinary mode, as no very easy part of the operation, I have used, with great advantage, an instrument combining the principles of a lever and a knife. The accompanying sketch (fig. 311) will convey a much better idea of it than the most elaborate description. The blade is slightly curved upon the flat, and is three inches and a quarter in length, by three-eighths of an inch in width; its thickness is about one line and a third. Its free extremity terminates in a convex edge, beveled off in front and behind, so as to admit of being used for dividing the periosteum, or scraping the bone, as may be deemed necessary. The other extremity is set in a stout, rough handle, nearly four inches long. A perfectly straight instrument (fig. 312) of this kind may be used with much advantage. The body and ramus of the jaw being detached from its connections, the semi-blunt edge of the elevator is insinuated beneath the fibrous covering of the coronoid process, and after separating it for some distance, the bone is prized

Fig. 311. Fig. 312.



out. In the same manner the soft structures may be peeled from the condyle of the jaw, and the latter lifted from the glenoid cavity. The whole procedure is the work of a few seconds, and its great beauty, as was before stated, is its entire freedom from danger to the maxillary and other arteries, as well as the trunk and deep-seated branches of the portio dura. When these processes with their investing structures are perfectly sound, the separation must be effected, at least in part, with the knife, but even here the instrument above described will afford valuable aid.

The gap left by this operation is often filled up, especially in young subjects, by a cartilaginous formation, of an irregularly cylindrical shape, which, while it serves to support the jaw in mastication, assists materially in re-establishing the symmetry of the features. The time required for the production of this substitute varies, it may be supposed, in different cases, from a few months to several years. Even when one-half of the bone has been removed, nature sometimes succeeds most admirably in her object. In 1832, I had an opportunity of seeing an Irish lad, aged seventeen years, from whom Dr. Cusack, of Dublin, had extirpated, four years previously, the left half of the inferior maxilla, on account of a fibro-cartilaginous affection. In this instance, nature had made an attempt at reproduction, by means of a thick, rounded piece of cartilage, sufficiently strong to subserve the ordinary purposes of mastication, which was performed with the greatest facility.



## SECT. III.—AFFECTIONS OF THE TEETH.

The diseases of the teeth are of too frequent occurrence, and too severe in their character, to justify their exclusion altogether from a work on surgery; it is true there are numerous monographs on dental science, but so there are on every other subject, and if we go on the principle of omitting everything thus published, there will really be very little left for the formation of a systematic treatise on any branch of the healing art. A knowledge of the affections of the teeth is of great importance to every physician, but it is particularly so to the country practitioner, who, in consequence of his remoteness from the regular dentist, is often obliged to extract teeth, and to give advice in regard to their diseases.

1. *Sympathies*.—The sympathetic relations of the teeth are adverted to in the first volume, in the chapter on Irritation. Their influence in inducing and maintaining ill health in the jaws, gums, eyes, ears, head, and lymphatic ganglions, as well as in other parts of the body, is displayed in a great variety of ways, and deserves the most careful consideration of the general practitioner. Without an intimate knowledge of their relations, he must remain ignorant of the pathology of some of the most common affections about the head and face, and be, consequently, unable to treat them upon correct scientific principles.

2. *Dentition*.—In children, during the progress of the first dentition, the surgeon is often called upon to relieve suffering on account of the pressure upon the gum by an advancing tooth, or, perhaps, more correctly speaking, the gum and the membranous cyst by which the tooth is surrounded. A great deal of irritation may thus be induced, which causes not only much local distress, but occasionally, also, much disturbance in the other organs, especially of the brain, stomach, and bowels. In the more severe cases, the gum is red, tumid, and tender, the mouth is hot and dry, and the child is thirsty, feverish, and restless. Not unfrequently convulsions, coma, and death follow, from arachnitis, gastritis, or enteritis, or from a combination of these diseases.

The proper remedy for difficult dentition is free division of the gums and the inclosing membrane of the advancing tooth. The operation is usually performed with what is called the gum lancet, but a far better instrument for this purpose is the blade of an ordinary pen-knife, the point of which, being very narrow and sharp, is thrust down in contact with the offending tooth, which is thus at once liberated from its confined position, much to the comfort both of the parts and of the system. The head of the little patient, during the operation, is held between the surgeon's knees, an assistant having charge of the rest of the body. In dividing the gum over the large grinders, a crucial incision is usually made, whereas a single one will always answer for the incisors. Very little bleeding follows the operation, generally just enough to relieve the engorged vessels; but now and then, as happened to me in one case, many years ago, it is so copious as to prove fatal, although such an event is not to be looked for unless there is a hemorrhagic diathesis. It has been objected to this operation that, when it is not followed by the immediate extrusion of the tooth, the

cicatrice that will form over it by the healing of the gum will afterwards render its eruption more difficult; but such a conclusion is altogether erroneous, it being well known that all new tissues are much more easily destroyed than old or pre-existing.

Excessive suffering is often experienced during the evolution of the wisdom tooth, in consequence of its pressure upon the gums and neighboring structures, which are frequently too small for its comfortable accommodation. The result is that the parts become inflamed, swollen, ulcerated, and excessively painful, causing, at the same time, great trouble in mastication and deglutition, with a feverish state of the system. The remedy consists in a free division of the affected tissues, or, what is better, the prompt removal of the offending tooth, especially when there is not room enough for its full and rapid development.

3. *Vicious Position.*—The teeth, as they issue from their sockets, sometimes take a vicious direction, thus materially interfering with the good looks of the patient, if not also with the comfort of the mouth. The causes under the influence of which such an occurrence may happen, are, first, imperfect development of the jaw, thereby crowding the teeth out of their proper position, and, secondly, the protracted retention of the first set, which thus arrest the progress of the second, as is so often witnessed in the superior maxillary bone of children.

The *treatment* of this affection must depend upon circumstances. When the jaw is manifestly too small for the advancing tooth, the best plan will be to extract it, so as to afford more room for the development of its neighbors; otherwise, unless the malposition is very great and disfiguring, an attempt should be made, by means of pressure, to force the organ gradually into its natural situation. For this purpose, the patient should be instructed to push the tooth, with his fingers, several times daily towards the place which it is desired it should occupy; or, if this fail, as it will be likely to do in cases of long standing, the rectification should be effected by keeping the tooth firmly tied to an adjoining one with a gum-elastic thread, a procedure which is often followed by the most gratifying results. When the old teeth are at fault, crowding the new out of place, they should be promptly extracted; when, sufficient room being afforded, the latter will generally soon assume their natural direction.

The malposition of the teeth is sometimes *congenital*, and then it is, perhaps, not so easily remedied. Thus, in hare-lip and cleft palate, the upper incisors are almost always badly formed, and thrust out of their natural situation. Instances also occur in which some of these organs are firmly united together by osseous matter; and Albinus has related a case where the crown of an eye-tooth was turned towards the maxillary sinus, the situation of the fang being reversed. A case precisely similar occurred in my practice some years ago, in a young lady of twenty-three. The irritation which it caused in the jaw gave rise to a tumor requiring surgical interference.

Fig. 313 represents the wisdom tooth of the upper jaw of the right side, inseparably fused with the fangs of the last grinder, the parts looking as if they had

Fig. 313.



been ingrafted upon each other. The tooth was situated horizontally under the gum, by which it was nearly concealed; it was extracted from a woman, aged thirty years.

Fig. 314.



Cases occur in which the fangs of the teeth are very crooked, thus opposing a great obstacle to their extraction. Such a malformation is represented in fig. 314, where two of the roots are nearly horizontal. In a second series of cases all the roots are remarkably divergent; while in a third, they are, perhaps, all soldered together by osseous matter. I have several specimens in my collection, in which the teeth are

inseparably connected, in a similar manner, with the walls of their sockets.

4. *Dislocation and Fracture*.—A tooth is sometimes dislocated, or lifted out of its socket, in consequence of external violence, as a kick, blow, or fall. Occasionally the accident takes place during an awkward attempt at extracting a diseased tooth. However induced, the proper remedy is immediate replacement of the organ, the socket having been previously cleared of blood, and retention being aided by accurate closure of the lower jaw by means of a bandage, until the parts have become reunited. The adhesion, however, is generally imperfect, and it is seldom that the tooth afterwards subserves any very useful purpose, as it is very apt to remain sore and tender, and, ere long, to drop out.

The crown of a tooth, when broken, cannot reunite, but observation has shown that a fang may, the process being similar to that of a fractured bone, whose structure it closely resembles. The blood poured out at the moment of the accident being absorbed, lymph is effused, which thus becomes the basis of the new osseous substance.

5. *Ætal Changes*.—The teeth experience important changes in consequence of age. As life advances they gradually lose their whiteness, and assume a peculiarly yellowish tint, which is often remarkably conspicuous in old people. They become likewise more brittle, and the enamel exhibits an irregularly abraded appearance. These changes are produced by certain alterations which take place in the anatomical constitution of the teeth, from the obliteration of their vessels, and their consequent diminished supply of blood.

There is a singular affection of the teeth, described by dentists under the name of "the denuding process," the precise nature of which is still unexplained. It consists in the gradual removal of the enamel, generally without the slightest discoloration or diseased appearance. It is most frequently observed in the incisors, especially the inferior, but occasionally attacks the whole dental arch. As the denuding process advances, the crown of the tooth is slowly worn away, the enamel first disappearing at the top, and subsequently at the sides, until the greater part is removed. The organ, in the meanwhile, changes its color, gradually becoming more yellow, and finally, when the enamel is completely destroyed, assuming a brownish aspect. The most curious circumstance in the history of this lesion is the beautiful provision by which the cavity of the tooth is protected from exposure.



This consists in a deposit of new bony matter, perfectly hard and solid, but so transparent that nothing but the closest examination can detect it. Thus a sort of permanent plug is formed, which effectually defends the delicate structure within, and which exactly resembles the transparent layers of an ægose pebble, surrounded by a more opaque mass. In what this lesion essentially consists it is not easy to determine, though it is not improbable that it depends upon some original or acquired defect of the enamel, whereby it is made to yield more readily to the mechanical attrition to which the teeth are constantly subjected. It is witnessed at nearly every period of life, but is by far most common in old people.

6. *Gangrene*.—Necrosis of the teeth is usually caused by external violence interrupting their vascular connections, the effects of mercury, or a syphilitic taint of the system. In scurvy, too, they often lose their vascular relations, and ultimately perish. When affected in this way, they assume a dull, yellowish, brownish, or blackish appearance, and finally drop out of their sockets. In most cases, the death is universal; not limited to particular parts of a tooth.

A necrosed tooth always acts as a foreign body, causing pain and inflammation in the surrounding soft parts, as well as absorption of the alveolar process. It is for this reason that it should always be promptly extracted.

7. *Caries*.—The most common, and generally also the most distressing disease of the teeth is what is termed caries; an affection whose true nature appears to be still imperfectly understood, notwithstanding the numerous attempts that have been made to investigate it. Many pathologists, convinced that even the enamel, where the lesion always begins, possesses a sort of life-power, maintain that it is strictly analogous to ulceration of the osseous tissue; while others, equally respectable, assert that it is wholly dependent upon chemical action, effected by the acid secretions of the mouth, and they further insist upon it, as an additional proof of their position, that these secretions, like the caries itself, are almost exclusively met with in dyspeptic persons, or individuals laboring habitually under disorder of the digestive apparatus. The arguments adduced by the advocates of this opinion are certainly very plausible; at the same time, however, it is so repugnant to our preconceived notions of the nature of morbid action generally that it is extremely difficult to adopt it. Perhaps it would be more philosophical to say that dental caries was the result partly of a vital, partly of a chemical process; or, what would probably be still nearer to the truth, that chemical action was the exciting and molecular disintegration the immediate cause of the disease.

Caries always begins in the enamel of the teeth, at some point of the crown, in the form of a minute, opaque, brownish speck, which gradually extends towards the centre of the organ, assuming at length a blackish color, and becoming so soft and brittle as to be crushed on the slightest touch. Thus a large cavity is exposed, whose existence perhaps had not previously been at all suspected. As it advances, the disease frequently destroys the entire crown, or converts it into a dark, pulverulent substance, without any trace of its primitive

texture. The roots are usually the last to decay, and it often happens that they retain their vitality long after the other parts have completely perished. In this condition, however, they act as extraneous bodies, exciting ulceration of the gum and alveolar processes, whereby they lose their connection, and are finally dislodged.

Figs. 315, 316, and 317 exhibit some of the more ordinary forms of this disease, from specimens in my collection.

Fig. 315.



Fig. 316.



Fig. 317.



The teeth most liable to this disease are the last grinders, probably from some defect inherent in their constitution in consequence of their late development. The upper central incisors are also frequently affected, as are likewise the first molar teeth, particularly those of the under jaw. The lower incisors, on the contrary, are rarely attacked. Every part of the crown appears to be equally liable to caries; and it often happens that the disease begins simultaneously at several points.

Persons of a tubercular constitution are very subject to this species of decay, which often sets in at a very early period of life, and proceeds until nearly every tooth is destroyed by it. The upper incisors of children are frequently attacked in this way within a short time after their appearance, and occasionally, indeed, when they are still partially covered by the gum. There is sometimes an hereditary proclivity to this disorder; as is evinced by the fact that it often occurs in a considerable number of members of the same family, and in the children of parents who had been similarly affected.

Among the indirect causes of caries are, disorder of the digestive organs, the inordinate use of mercury, a syphilitic taint of the system, and, in short, whatever has a tendency to derange the general health. Among the local, or direct causes, are an accumulation of tartar upon the teeth, want of cleanliness of the mouth, and steady, persistent pressure of the teeth against each other.

The *effects* of caries are pain in the teeth, and inflammation of the gums, jaws, and other structures. The pain may be very slight, or extremely violent; in general it is of a throbbing character, darting about in different directions, aggravated by recumbency, and attended with more or less soreness of the mouth and cheeks. Gum-boils are a frequent consequence of the disease.

The *treatment* of caries must be regulated by the circumstances of the particular case. If the disease is extensive, the only proper remedy is extraction of the affected tooth, especially if it be attended with

much suffering. If, on the contrary, it is slight, and the patient can bear the pain, the tooth should by all means be preserved, the cavity being excavated by appropriate instruments, the object being the removal of every particle of the affected structure, and the filling of the hole with gold leaf. When the operation is properly executed, the plug being firmly inserted, so that not a particle of air or fluid shall afterwards enter by the side of it, the tooth may be preserved for an indefinite period, without any impairment of its usefulness.

When there is a strong tendency to caries, much may be done, in preserving the teeth, by way of attention to the general health and constant cleanliness of the mouth. The latter object is best attained by the daily use of a good, stiff brush, in the morning on getting up, and also after each meal, so that there shall be no chance whatever of the accumulation of tartar, food, alkali, or acid upon, around, or between any of the teeth. The brush may be employed either alone with cool or tepid water, or, what is better, with a little soft toilet soap, prepared expressly for the purpose. When there is great tendency to the collection of calcareous matter, recourse must be had to some dentifrice, consisting mainly of prepared cinchona, chalk, orris root, and pumice stone, reduced to an impalpable powder.

8. *Inflammation of the Lining Membrane.*—The membrane lining the cavity of the teeth, generally considered as of a fibrous nature, occasionally takes on inflammation, the other anatomical elements being apparently in a sound state. The disease, if allowed to go on, almost always leads to the formation of an alveolar abscess. In other cases, there is a pretty abundant deposit of fibrin, both within the canal of the affected organ and around its roots, the latter of which exhibit a singular shreddy aspect, the plastic, organized lymph hanging from the thickened periosteum in all directions (fig. 318). Occasionally, again, though this is not very common, purulent matter is poured out, forming an abscess analogous to what is sometimes observed in the interior of a bone. When the quantity of fluid is considerable, it is very apt, from its confined situation and consequent pressure, to produce mortification of the lining membrane, with absorption of the parietes of the cavity. By this means the pus gradually escapes at the extremity of the fang, the foramen of which is much enlarged. Ulcerative inflammation is next set up in the alveolar process and gum, which continues its ravages until the inclosed matter, now extremely offensive, obtains an outlet, the affected tooth meanwhile losing its vitality, and presenting a dull yellowish, dark, or brownish color.

The exposure of the internal membrane from gangrene, fracture, or other causes, not unfrequently leads to the formation of *fungous tumors*, varying in volume between that of a pin-head and an ordinary pea (fig. 319). Of a pale reddish color, they are of a soft, fleshy consistence, and are essentially composed of a plexus of vessels, connected together by delicate cellular substance, and traversed

Fig. 318.



Fig. 319.





by minute nervous filaments. From their excessive vascularity, these growths are liable to bleed upon the slightest touch; and, although they are occasionally as insensible as healthy gum, yet in the majority of cases they are the seat of the most exquisite pain. The period required for their development varies from a few months to several years; but from the great suffering which they induce, they are seldom permitted to remain for any length of time. They appear to arise, for the most part, from the lining membrane of the fang, from which they proceed more or less rapidly until they fill the whole cavity of the organ. Occasionally, there is reason to believe that they spring directly from the dental nerve, which becomes exceedingly vascular, elongated, and thickened, forming a species of neuroma. The teeth most frequently affected with this disease are the central incisors and the large grinders. Such a tumor is occasionally the seat of periodical hemorrhage, apparently vicarious of the menses.

9. *Dental Periostitis*.—The sockets of the teeth are invested by a fibrous membrane, which is reflected over the fangs and body of these organs, thus serving to maintain them in their proper position. The membrane, which is extremely vascular, is liable to inflammation and its several consequences, especially thickening and the formation of matter. The disease, anatomically considered, is characterized by deep congestion of its vessels, and by a softened, pulpy state of the membrane, and frequently terminates in suppuration and abscess. As the inflammation progresses the periosteum is detached at the most highly

Fig. 320.



Fig. 321.



inflamed part, which is usually around the extremity of the fang, and the sac thus formed becomes the receptacle of the pus. The denuded portion of the tooth loses its vitality, thereby adding to the irritation of the socket, which, in consequence, takes on ulcerative action, followed by a fistulous opening, and the escape of the accumulated fluid. If the tooth be extracted after this occurrence, the sac will often come away in the form of a red, fungous mass, not unlike a small polyp. Figures 320 and 321 afford excellent illustrations of different forms of the sac in alveolar abscess.

Dental periostitis sometimes occurs as an independent affection, but in most cases it is caused by the irritation of a decayed tooth, or by external violence. However induced, the pain is usually excessive, pulsatile, and accompanied with great swelling of the surrounding parts, especially of the face. Severe constitutional disturbance often attends, especially when matter is about to form. The fluid always collects on the outside of the gum, as if nature were averse to making an opening in any other part of the alveolar process.

The *treatment* of this affection is strictly antiphlogistic; by leeches and purgatives, followed by anodynes and diaphoretics, fomentations and poultices. The leeches may be applied directly to the inflamed gum. If matter forms, it must be promptly evacuated, otherwise it

will not only keep up the pain, but may cause extensive destruction of the periosteum and bone.

10. *Exostosis*.—The teeth, especially the grinders, are liable to exostosis; a circumstance not surprising when it is recollected that, with the exception of the enamel, they are essentially composed of the same anatomical elements as the bones. The substance which is thus added differs from the pre-existing structure principally in being of a denser consistence, and of a yellowish, transparent aspect, not unlike chalcedony. The deposit ordinarily takes place at the root of the organ, but in some instances it affects the body, and it may even extend as high up as the crown. Analogy would lead us to infer that the new matter is furnished exclusively by the vessels of the periosteum; and this is, doubtless, generally the fact. The progress of this disease is always tardy, a long time elapsing before the bony tumor acquires much bulk.

The symptoms of dental exostosis are too obscure to be of any diagnostic value. The pressure of the tumor upon the surrounding parts must necessarily cause more or less pain, which, however, it is impossible to distinguish from that of ordinary toothache. The only remedy is extraction of the offending organ.

11. *Formation and Accumulation of Tartar*.—The teeth, from want of cleanliness, as well as other causes, are very prone to become affected with earthy deposits. Originally, the substance possesses the character of a soft, friable, porous paste, which by degrees acquires the consistence of hardened mortar, and then often scales off in large masses, having the shape of the organ around which it was formed. Its usual color is a dull whitish yellow, though in some cases it is dark brown, blackish, or slightly greenish. It is principally composed of phosphate of lime, in association with mucus and a small quantity of animal and fatty matter.

The accumulation of this substance, vulgarly called *tartar*, often takes place with great rapidity, so that in a short time the dental arches are almost completely incrustated with it. Calculous, gouty, and dyspeptic persons are particularly liable to it; and it is also frequently witnessed during pregnancy and lactation. The deposit ordinarily begins around the necks of the teeth, just beneath the free margin of the gum. As it increases in quantity, it produces the most disastrous effects, exciting irritation in the soft parts, which, in its turn, leads to absorption of the gum and alveolar processes, until the teeth, deprived of their support, are loosened, and at length drop out.

It has been supposed that this matter is derived directly from the mucous secretions of the mouth, vitiated by chronic irritation; but the more plausible opinion is that it is exclusively furnished by the salivary glands, being held in solution by the fluid which it is the office of these organs to elaborate. This view of the subject is not only supported by the analogy which obtains in the formation of urinary calculi, but by the fact that this substance is always most abundantly deposited upon the superior grinders and the inferior incisors, teeth which lie in the immediate vicinity of the orifices of the salivary ducts; and also by the circumstance that it is composed of the same elements as the salivary secretion.

The *treatment* of this affection consists in its early removal by means of a brush and soft powder; or, if this be inadequate, by a suitable scaling instrument. If the matter be very firmly adherent, the operation must be performed with great care, otherwise there will be danger of loosening the teeth, as the point of the instrument is carried around their necks, between the gum and the concretion. Re-accumulation is avoided by diligent attention to cleanliness and to the general health.

12. *Toothache*.—This affection, technically known as odontalgia, is usually caused by caries of the teeth, leading to exposure of the nerve-pulp to the air, to the juices of the mouth, and to various kinds of extraneous matter. It may also be caused by inflammation and thickening of the dental periosteum, by necrosis of the teeth, exostosis, external injury, profuse salivation, and various morbid affections of the gums and jaws. There is a form of odontalgia which occurs in gouty, rheumatic subjects, apparently unconnected with any organic lesion whatever of the teeth. Occasionally, again, the disease is of a neuralgic character, coming on in violent paroxysms, which, however, seldom observe any regularity in regard to the period of their recurrence.

However induced, odontalgia is generally characterized by atrocious pains, of a throbbing, jumping nature, deep seated, and, although most severe at the seat of the disease, darting with great violence along the branches of the fifth pair of nerves distributed to the affected jaw. In some cases, the pain is dull, aching, or gnawing. It is always aggravated by exposure to cold, by disorder of the general health, by cold and hot drinks, by acid, alkaline, and saccharine matter, and by recumbency. Hence, it is almost always worse at night after the patient retires to his bed, the throbbing commencing the moment the head touches the pillow. In the more severe forms of odontalgia, the pain extends to the ear along the nervous cord of the tympanum; and there is generally great soreness of the face, temple, and even the corresponding side of the head. Children, pregnant women, and dyspeptic persons are extremely prone to suffer from toothache from the most trivial circumstances.

The *treatment* of odontalgia must depend very much upon the nature of its exciting causes. When it has been induced by caries, and the decay has advanced so far as to render the preservation of the tooth a matter of impossibility, the only proper remedy is immediate extraction, before there is any serious inflammation of the gum and jaw. The same course is pursued when a tooth is necrosed, or the seat of exostosis; when there is chronic thickening of the dental periosteum, with the repeated formation of abscesses; or, finally, when the affected organ has measurably lost its connection with the alveolar process, whether from disease in the organ itself, or in the jaw. If, on the contrary, the decay is comparatively trifling, an attempt should be made to retain the tooth, and with this view the cavity should be gently filled with cotton, wet with a strong solution of morphia, aconite, and tannin, which often arrests the pain in a few minutes. If the suffering is very severe, the patient should at once take an active cathartic, especially if there be considerable derangement of the gene-



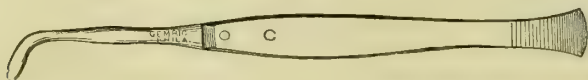
ral health. The medicine may be followed, if necessary, by a full anodyne and diaphoretic. Should there be much swelling of the gums, a few leeches may be applied, or, if these cannot be had, the parts may be freely divided with the knife. Pain in the ear is best relieved by laudanum, and of the face by a hop poultice, or, what is better, an ammoniated liniment, strongly charged with morphia and tincture of aconite. When the pain is dependent upon malarious influences, quinine and arsenic will be proper; if upon a gouty or rheumatic diathesis, relief will probably be afforded by colchicum. If matter form, it must speedily be evacuated. The offending tooth should not be extracted so long as there is much inflammation. If the organ can be saved, it should be plugged as soon as it can bear the necessary manipulation. Of the numerous domestic remedies for odontalgia, there is not a solitary one deserving of any attention; most of them, in fact, are much more hurtful than beneficial.

13. *Extraction of Teeth.*—Extraction of the teeth may become necessary for various reasons, but more especially for the relief of pain consequent upon caries and necrosis of these organs, and on account of the irregularity of their position. In children, the operation is often required to make way for the permanent teeth. The deciduous teeth are always easy of extraction, owing to the partial absorption of their roots; the permanent, on the contrary, often demand great skill for their successful removal, especially when they are much decayed, when they are unusually brittle, or when their fangs are very firmly adherent, or widely spread out. In the former case, they will be very apt to break off, while, in the latter, it is sometimes impossible to dislodge them without fracturing the alveolar process. There is generally a great prejudice, even on the part of dentists, against the extraction of the deciduous teeth, on the supposition that it has a tendency to interfere with the development of the permanent set; I have been at much pains to inquire into this matter, and am satisfied that the idea is altogether erroneous; on the contrary, the operation, so far from being injurious, will generally be found to be eminently beneficial, not only relieving pain, but conducing to the beauty and perfection of the future organs.

The patient, during the operation, sits upon a chair or a low stool, as may be most convenient; if the surgeon stands behind, he himself, of course, supports the head, otherwise this function is performed by an assistant. The office of the dentist is always furnished with a high-backed chair, for the accommodation of the head. If chloroform be given, the patient must be partially recumbent, and it will be well not to carry the anæsthetic effect to complete unconsciousness, lest harm should result. Ether is, however, on the whole, more safe for the extraction of the teeth, and should, therefore, be preferred, especially as its administration does not require recumbency, or much care of any kind. If the patient be an adult, it will be proper, as a preliminary measure, to separate the gums carefully from the affected tooth, down to the very neck of the organ, with the twofold object of preventing laceration of the soft parts, and of facilitating the extraction; but in the child, no such precaution is ever required, as the connection

between these structures is much less intimate than in the adult. The operation is readily performed with what is called the gum lancet, represented in the adjoining cut (fig. 322).

Fig. 322.



The *instruments* required for the extraction of the teeth are the forceps, key, elevator, and hook, the latter two being particularly useful in the removal of stumps, and of loose, deciduous teeth.

1. *Forceps*.—The forceps should be provided with short, stout blades, variously shaped, with a view to their easy adaptation to the different classes of teeth, as well as the same classes in the two jaws, and be rather sharp at the edges, that they may be readily passed down between the gum and the tooth, in close contact with the border of the alveolar process. The instrument should be large in the handle, so as to afford a firm grasp for the hand. The annexed cuts (figs. 323, 324, 325)

Fig. 323.



Fig. 324.



Fig. 325.



represent the different forms of forceps usually found in the dentist's case; but the ordinary operator will rarely require more than two, one straight, for the incisors and cuspids, the other curved, for the bicuspid and grinders.

The incisors, cuspids, and bicuspid are extracted on the principle of rotation and traction, the first movement being intended to

separate the tooth from its connections, and the second to lift it from its socket. Usually more force is required for the removal of the cuspids and bicuspid than for the dislodgment of the incisors. The rule is to apply the blades of the forceps as near as possible to the edge of the alveolar process, as seen in the annexed cut (fig. 326). This procedure, which should not be deviated from in any case, is particularly necessary when the tooth is much decayed. The instrument should be held firmly in the hand, but no more force should be applied than is absolutely necessary to prevent it from slipping. If this precaution be neglected, there will be great danger of crushing the tooth, and so complicating the operation. In extracting a bicuspid, the organ should be loosened by pressing it several times outwards and inwards, as it is, in great measure, insusceptible of rotatory motion; as soon as it begins to yield, dislodgment is effected by elevating or depressing the hand, according as the tooth is a lower or an upper one.

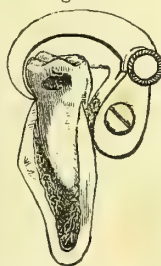


Extraction of the molar teeth, or grinders, is effected on the same principle as that of the bicuspid; that is, the forceps are applied very firmly to the neck of the organ, which is then pressed several times outwards and inwards, until it feels decidedly loose, when it may be readily disengaged from its socket. The wisdom teeth, owing to the shortness of their roots, are always easily removed, comparatively little lateral motion and traction sufficing for the purpose. The most suitable instrument for the extraction of the lower wisdom teeth is the scissor-bladed forceps, now generally used by dentists.

2. *Key*.—The key is now seldom employed for the extraction of the teeth; it is an awkward, clumsy instrument, and often does great mischief, bruising and lacerating the gum, splintering the alveolar process, and inflicting severe pain. Moreover, unless particular care be taken in its application, the operation is very liable to be attended with fracture of the body of the tooth, leaving the fangs in their sockets, from which it will afterwards be extremely difficult, if not impossible, to dislodge them. The forceps, therefore, always deserve a decided preference. Nevertheless, there are circumstances which may render a resort to the key very proper, if not absolutely indispensable; especially when the teeth are unusually large, or very firmly imbedded in the jaw, and the operator does not possess the requisite strength for the efficient use of the forceps.

The application of the key is conducted upon the same general principles as that of the forceps. The gum being well separated, the point of the instrument is pressed down between it and the neck of the tooth, which is then lifted perpendicularly, or nearly so, from its sockets, the whole procedure consisting in a forcible

Fig. 327.



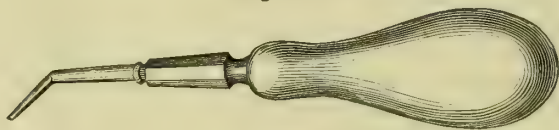


dislocation of the organ. If the key is too long, or applied too high up, it will almost inevitably break off the crown, or fracture the jaw. The proper position of the instrument is exhibited in the adjoining sketch (fig. 327). To guard against mishaps, the surgeon should be provided with several keys, of different shapes and sizes, so as to adapt them to the exigencies of each particular case.

In operating upon the inferior bicuspid and the upper grinders, the fulcrum is applied to the inner surface of the jaw, and to the outer in operating upon the lower grinders, the wisdom teeth being always removed with the forceps.

3. *Elevator and Hook*.—The elevator (fig. 328) is admirably adapted

Fig. 328.



to the removal of stumps and fangs. Great care, however, is necessary in its use, otherwise it might slip, and so inflict severe injury upon the mouth. Such an accident is best avoided by firmly steadying the patient's head, and planting the point of the instrument securely against the projecting portion of the tooth, which is then forcibly raised from its socket.

For the removal of small fangs, or fangs that are deeply buried in the jaw, the most suitable instrument is the one depicted in the adjoining sketch (fig. 329). In order to facilitate dislodgment under such circumstances, it is sometimes necessary to cut away a small portion of the alveolar process, an operation which is easily done

Fig. 329.



with a stout, narrow scalpel.

4. *Hemorrhage after Extraction*.—It is very unusual for extraction of the teeth to be followed by hemorrhage, the loss of blood rarely exceeding a few drachms. Occasionally, however, owing to idiosyncrasy, or to an unnatural disposition of the dental artery, the bleeding is both troublesome and profuse, causing, perhaps, great anxiety for the patient's safety. I have myself seen several instances of this kind, and am familiar with the history of two in which the loss of blood terminated fatally. The hemorrhage occurs at various periods after the operation; sometimes immediately, and at other times not until after the lapse of several hours, or, it may be, even several days. The blood may issue from one particular vessel, or ooze away from numerous points; the latter form being the more common when the patient is laboring under a hemorrhagic diathesis.

The treatment of this variety of hemorrhage consists in plugging the socket from which it proceeds with a piece of soft sponge, wet with a saturated solution of alum and tannin, or, what is better, the persulphate of iron, the cavity having been previously well cleared. The sponge is confined by a thick, narrow compress, and the jaws are

firmly closed by a roller passed round the head. The patient is kept in the semi-erect posture in bed, and a full anodyne is administered to allay the heart's action. The diet and drinks must be cooling. If the hemorrhagic diathesis exist, recourse must be had to the exhibition of the persulphate of iron, with a view of promoting the coagulation of the blood. In obstinate cases, or, where plugging is impracticable, on account of fracture of the alveolar process, the actual cautery may be necessary.

In the eighth volume of the Medico-Chirurgical Transactions of London, will be found the particulars of a case in which Sir Benjamin Brodie tied the common carotid artery, on account of hemorrhage from the second branch of the internal maxillary, after the extraction of the second molar tooth of the upper jaw. The patient, however, perished.

#### SECT. IV.—AFFECTIONS OF THE GUMS.

The gums are liable to various accidents and diseases, of which the most important are wounds or lacerations, inflammation, ulceration, gangrene, scorbutic enlargement, and malignant disease. They are also occasionally the seat of congenital hypertrophy.

1. *Wounds*.—Wounds and lacerations of the gums require no particular attention in a work of this kind; they are usually the result of falls or blows, fracturing the jaws, or of the extraction of the teeth, and should be managed upon the same general principles as similar lesions in other parts of the body. A good deal of bleeding sometimes attends them, which, however, either ceases spontaneously or is easily arrested by astringent lotions, especially strong solutions of alum and tannin, or, what is still better, the persulphate of iron.

2. *Inflammation*.—Inflammation of the gums may be caused in various ways, as an accumulation of tartar around the teeth, disorder of the digestive apparatus, a depraved state of the blood, and the effects of mercury and phosphorus. The symptoms are, discoloration, with a soft and spongy state of the affected structures, more or less pain, and an increase of the mucous and salivary secretions. When the disease is severe or protracted, the teeth are apt to become loose, and the patient finds it difficult to masticate his food.

The *treatment* must be regulated by the nature of the exciting cause. Calculous deposits must be removed, the condition of the digestive organs rectified, and the general health improved. The milder cases will often get well spontaneously, or under the influence of a brisk cathartic and the use of an astringent mouth-wash. When the inflammation has been occasioned by mercury, the most appropriate remedies are purgatives, strong lotions of acetate of lead, and the liberal exhibition of chlorate of potassa, with leeches and warm poultices to the neck and jaws. In obstinate cases emetics of ipecacuanha will prove useful.

3. *Ulceration*.—One of the most frequent lesions of the gum is ulceration, produced by an accumulation of tartar around the necks of the teeth. The pressure that is thus exerted excites inflammatory action, leading to great thickening, sponginess, and discoloration of

the gum, with erosion of its substance. In this way the teeth are entirely denuded at their necks, in consequence of which they often drop from their sockets, or become so loose as to be useless. The treatment consists in the removal of the offending tartar, and the use of medicated lotions, containing alum, tannin, and myrrh. The milder cases will generally rapidly yield under the application of powdered alum.

4. *Mortification*.—The gum, in common with the rest of the mucous membrane, is liable to mortification, from excessive mercurial action, the fumes of phosphorus, and probably also from causes which exert their influence chiefly through the constitution. Of this nature appears to be that variety of mortification which has been so ably described by the older writers under the name of “black canker,” and by Dr. B. H. Coates, of this city, under that of the “gangrenous ulcer” of the mouth. Although it may begin at any part of the mucous membrane, yet, in by far the greater number of cases, it makes its appearance at the edges of the gum, over the neck of the central incisors of the lower jaw, in the form of a whitish, cineritious, or reddish ulcer, which varies in diameter from half a line to the eighth of an inch. In this state, the disease may continue for several weeks, if not several months; but more commonly it extends its ravages, affecting either a large portion of the dental arches, or passing down in the direction of the sockets of the teeth, which, together with their periosteum and the alveolar processes, are gradually deprived of their vitality. The soft parts, in the meanwhile, assume a dirty, blackish appearance; and, on being detached, leave a ragged, sloughing ulcer, which is the seat of a foul, sanious discharge, of so excessively acrid a nature as to excoriate whatever texture it may touch. In this manner, the disease appears to be frequently propagated to the mucous membrane of the cheeks and lips, where it generally spreads with great rapidity, until the parts are completely perforated, or a black gangrenous spot manifests itself upon the external surface.

The true *pathology* of this disease is still involved in obscurity. It is almost wholly confined in its attacks to young, weakly subjects, and occasionally displays an endemic tendency. Thus, of 240 children observed by Dr. Coates in the Philadelphia Asylum, upwards of 70 were more or less affected with the primary ulcer at one time. In the early stage of the complaint there is little or no pain, the system is free from excitement, and the appetite and strength are scarcely at all impaired. When the sloughing process, however, has fairly commenced, the child suffers much local distress, and is harassed with constant fever. Dissection has thrown no light on this singular variety of gangrene.

The *treatment* of mortification of the gums must be regulated by the nature of the exciting cause. Supporting measures, as quinine, ammonia, and brandy, with a nutritious diet, are indispensable, and do more than anything else to arrest the spread of the disease. The most appropriate local remedies are lotions of acid nitrate of mercury, nitrate of silver, chloride of iron, and sulphate of copper, along with the liquid chlorinate of soda, for the purpose of allaying the excessive



fetor. If the disease extends to the cheeks, recourse may be had to the topical use of iodine.

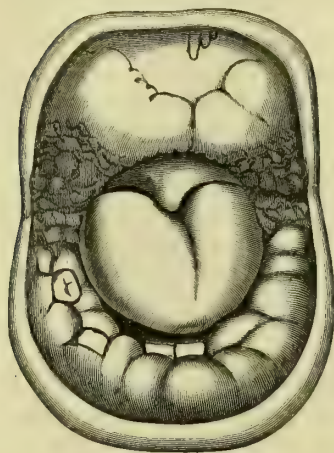
5. *Inflammatory Enlargement*.—Enormous enlargement of the gums is sometimes witnessed, especially in scurvy. When thus affected, they are of a red, livid, or purple appearance, and of a soft, spongy consistence, generally bleeding on the slightest touch, and forming two large ridges, in which the teeth, loose and discolored, are, at times, almost completely buried. The enlargement is of an inflammatory nature, and probably depends upon a depraved state of the system, produced by impoverished diet and other depressing influences.

The *treatment* is constitutional and local. Tonics, as quinine and the mineral acids, and nutritious diet, with brandy, wine, or porter, are generally required. When there is a marked scorbutic state of the system, subacid vegetables and drinks are indicated. The swollen gums should be frequently scarified, or even partially cut away, and touched once a day with a strong solution of nitric acid. In a remarkable case of this disease, which was under my charge in the Louisville Hospital, in 1851, more benefit was obtained from this application than from any other of the numerous articles that were tried, including creasote, copper, iron, myrrh, and alum. The teeth should not be extracted, unless they are hopelessly loose, as they generally regain their hold during convalescence. Any tartar that may incrust them should, of course, be carefully removed.

6. *Hypertrophy*.—The gums are subject to congenital hypertrophy, sometimes giving rise to remarkable deformity of the mouth and lips. The only case of the kind that I have ever seen came under my observation in 1855, in a lad ten years old, remarkable for his stunted development, ill-shaped head, and large abdomen. The morbid growth affected the gums of both jaws, and was of a dense, fibroid structure. It first began to attract attention at the age of nine months, but there can be no doubt, from its history, that it had existed from birth.

The gum of the upper jaw formed a tumor of a pale color, inelastic, perfectly insensible, and of firm consistence, presenting very much the appearance of the snout of a hog. It stood off very obliquely, and received but a very partial covering from the corresponding lip. It was rough on the surface, and was about an inch and a quarter in its antero-posterior diameter, its width having been about one inch and a half. At its free margin, which was quite irregular, was seen the tip of the left central incisor. Extending back from this tumor on each side of the whole length of the jaw, was the enlarged gum, forming a thick, broad ridge, completely imbedding the teeth. At several points, particularly behind, the morbid growth was more than nine lines in width; in front and at the middle it was less. It was of a more florid color than the main tumor, but of about the same degree of consistence. Opposite the bicuspid teeth, on each side, it exhibited a remarkably granulated appearance, the excrescences having a pediculated form, and being folded upon each other. Projecting towards the roof of the mouth, it greatly encroached upon this cavity, lessening its capacity, and thus interfering with its functions, as well as with speech and respiration.

Fig. 330.



The lower gum was in the same condition as the upper, being equally hard and insensible, but less developed. It was of a bluish florid complexion, and larger in front and behind than at the intermediate points; its free surface was uneven, and so prominent as to hide all the teeth, except the central incisors, the point of the right cuspid, and the cusps of each deciduous and first permanent molars. This singular formation is well shown by the accompanying cut (fig. 330). The treatment consisted in thorough removal, by means of scalpels and scaling instruments. A good deal of blood was lost, and the operation, which had to be several times repeated, was necessarily tedious. Dr. J. N. M. Lynch,

of New Concord, Kentucky, who was kind enough to bring this patient to me four years ago, has lately informed me that the gums have again commenced to grow, and that there is marked disease of the heart, with considerable enlargement of the tonsils, arches of the palate, and the papillæ of the tongue.

7. *Cancroid Disease*.—The gums are liable to carcinoma, generally of a secondary character, being caused by an extension of the disease from the lower lip and jaw. I have now under my care a man, aged fifty, in whom it began in the sublingual glands. Occasionally, however, it originates in the gum itself. In what is called epulis, described in a preceding page, the morbid action probably always, or nearly always, takes its rise in the periosteum of the teeth.

## CHAPTER XI.

## DISEASES AND INJURIES OF THE MOUTH AND THROAT.

## SECT. I.—AFFECTIONS OF THE LIPS.

THE lips are liable to wounds, hypertrophy, encysted tumors, eversion of their mucous membrane, carcinoma, and congenital fissure.

1. *Wounds*.—Incised wounds of the lips are treated with the twisted suture, and readily unite by the adhesive process. To insure this, however, and also to prevent deformity from unseemly scars, the edges should be carefully cleansed, and approximated with the utmost accuracy. The bleeding may be considerable, but is effectually arrested by the twisted suture, which is always preferable in this situation, both on this account and on every other, to the interrupted. The ligature is just as improper here as it is in the operation for hare-lip. Lacerated, punctured, and gunshot wounds of the lips are treated on the same principles as incised.

2. *Carbuncular Inflammation*.—The lip is occasionally the seat of a species of carbuncle, and if the case be misunderstood, or improperly treated, the results may be most disastrous to the beauty and symmetry of the features. The chief local remedy, of course, is free incision, made, if possible, on the side of the mucous surface, in order to avoid disfiguring scars. The application of iodine and suitable internal means will assist in preventing the spread of the disease.

In the New York Journal of Medicine and Surgery for May, 1854, Dr. Willard Parker has described what he calls a "Peculiar Form of Inflammation of the Lips and Face, resembling Malignant Pustule." In the three cases which illustrate his paper, the disease began in a pustule upon the lower lip, from which it gradually extended to the neighboring structures, as the cheeks, upper lip, nose, and neck, which soon became excessively hard, livid, painful, and greatly swollen, and finally the seat of gangrene. The affection was characterized by unusual depression of the vital powers, and two of the cases speedily terminated fatally. The patients were young men, of temperate habits, and, at the time of the attack, in the enjoyment of good health, none having been exposed to any poisonous influence, either local or constitutional. From the symptoms which attended the disease, it is obvious that it bears a greater resemblance to carbuncle and malignant pustule, especially the latter, than to any other known affection. For additional remarks upon this subject, the reader is referred to the communica-

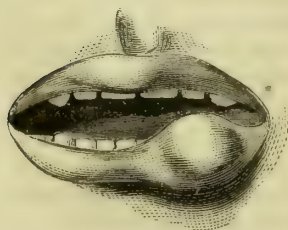


tion of Dr. Parker, and also to one by Dr. F. D. Lente, in the American Journal of the Medical Sciences for April, 1859.

3. *Hypertrophy*.—Hypertrophy occurs almost exclusively in the upper lip, in young scrofulous subjects. I have seen it most frequently in females, but males are by no means exempt from it. The lip is hard, firm, rigid, and more than double the natural thickness; the subcutaneous veins are unusually conspicuous; the skin is prone to ulceration; and the countenance has a singularly puffy and disfigured appearance. The disease is often associated with eruptions of the scalp, psorophthalmia, enlargement of the tonsils, and other marks of the strumous diathesis, and may last for months, and even years before it is finally eradicated. The best diagnostic signs are the firm and rigid feel of the part, as ascertained by the thumb and finger, the persistence of the swelling, and the absence of disease of the gums and teeth, together with the peculiar state of the system just mentioned. Attention to the chylopoietic organs, the exhibition of iodide of iron, and the topical use of tincture of iodine, or a weak ointment of iodide of lead, constitute the means which have succeeded best in my own hands. Occasionally the cure is greatly expedited by the application of a few leeches. In obstinate cases a mild course of mercury may be required. The operations which have been proposed, and occasionally performed for the relief of this affection, are entirely unnecessary.

A very rare species of hypertrophy of the upper lip, apparently altogether unconnected with the strumous diathesis, is occasionally met with. It occurs chiefly, if not exclusively, in young subjects between the ages of eighteen and thirty, and, while it involves all the structures of the part, it depends mainly upon a great increase of the mucous follicles, and their connecting cellular tissue. The glands vary in size from a mustard seed to that of a swan shot, and are so closely aggregated as to form a distinct tumor on each side of the middle line, of a deep red color. The inner surface of the tumor is dotted with numerous orifices, which are nothing but the mouths of the enlarged follicles, and which are constantly bedewed with mucous fluid, which stands upon them in small drops. The fibrous structure of the skin is remarkably developed, and the lining membrane is not only thickened but more or less chapped, ulcerated, or fissured. The lip has a hard, tough, leathery feel, is very prominent, and greatly everted at its free border. The external surface of the lip is generally natural. The affection is free from pain, but the part is stiff and devoid of feeling. The proper remedy is excision of an elliptical portion of

Fig. 331.



the everted lip, including the enlarged glands, and in approximating the edges of the wound with several points of the interrupted suture.

4. *Encysted Tumor*.—The encysted tumor is almost peculiar to the lower lip, on the inner surface of which it has its seat, as seen in the annexed cut (fig. 331), from one of my patients. It is usually solitary, and depends essentially upon the obstruction of

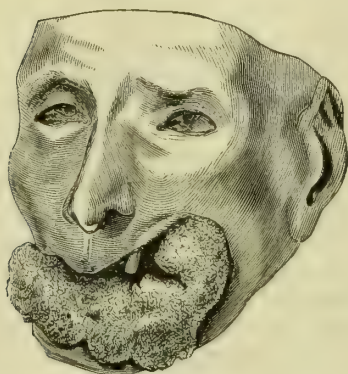
one of the glands which are found in such abundance in this situation. It is generally spherical in its shape, semi-pellucid, elastic, movable, and from the size of a cherry-stone to that of a hazelnut. Its walls are thin, but rather firm, and its cavity is occupied by a thick, glairy fluid, similar to the white of eggs. The ropiness of this fluid is sometimes remarkable, and cases occur in which it resembles the vitreous humor of the eye. The cystic tumor ordinarily forms without any assignable cause; its progress is slow, and it is seldom productive of much pain, the chief inconvenience which the patient suffers being a certain degree of stiffness of the lip. Sometimes it ulcerates and discharges its contents, when it is apt to become sore and painful. So far as I know, the first account of this disease was published in my *Elements of Pathological Anatomy*, in 1839. A similar, but smaller tumor, occasionally forms on the free margin of the lower lip.

In the early stage of this affection a cure may occasionally be effected by the application of the tincture of iodine, especially if the tumor has been previously punctured, so as to afford an opportunity for the escape of its contents; but, in general, the most certain remedy is incision with enucleation of the cyst, which, as I know from experience, is always easily accomplished with the forceps. In old cases, when the cyst has contracted firm adhesions to the surrounding structures, a portion of it may be cut away, and the remainder cauterized with the nitrate of silver. Unless perfect removal is effected, reproduction of the disease may be anticipated. When the tumor is seated on the free margin of the lip the preferable operation is excision, on account of the difficulty of enucleation.

5. *Cancer*.—It is a very singular and inexplicable fact that, while the upper lip is the exclusive seat of hare-lip, the lower lip is almost the exclusive seat of carcinoma. This disease, which is peculiar to those of advanced years, occurs in both sexes, and may begin in a small, bluish, shot-like tumor, just beneath the mucous membrane, in a dark, warty excrescence, or in a small cleft, chap, or fissure. The probability is that it generally takes its rise in one of the mucous follicles, or in the submucous cellular tissue, from which it gradually extends to the other component elements of the lip, which often, in consequence, acquires an immense bulk. The part, at first, feels stiff and uncomfortable, it then becomes hard and rigid, and, finally, giving way at one or more points, it forms a large ulcerated mass, having a foul, bleeding, fungous appearance. The pain, from the start, is characteristic, being lancinating, pricking, aching, burning, or scalding, darting about in various directions with the rapidity of lightning. The ulcerated surface is the seat of a sanious, fetid, and irritating discharge, and, at times, of considerable hemorrhage. As the malady progresses, it gradually invades the gums, jaws, and neighboring lymphatic ganglions; the teeth become loose and finally drop from their sockets, the countenance exhibits a peculiar cadaverous aspect, the body becomes rapidly emaciated, and the poor patient is ultimately worn out by hectic irritation. The period at which death occurs is subject to considerable diversity; but, in general, it ranges from nine to eighteen months from the commencement of the malady.

The annexed sketch (fig. 332), taken from one of my private cases, exhibits this disease in its latter stages, long after the occurrence of ulceration. The microscopical characters of cancer of the lip are shown in (fig. 333) from a drawing by Dr. Da Costa.

Fig. 332.



Epithelial cancer of the lower lip, in an advanced stage.

Fig. 333.



*a.* Papilla taken from an epithelial cancer, magnified 250 diameters. *b.* Separate epithelial cells.

The *causes* of cancer of the lip are unknown. Writers and teachers who profess to be deeply versed in the etiology of the affection, have gravely referred its origin to the habit of smoking with a short clay pipe, which, becoming heated, irritates the mucous structures, and thus lays the foundation of the disease. Such an opinion would be entitled to respect, if it were not for the fact that the subjects of cancer of the lip often do not use tobacco in any form whatever. While we are ignorant of the real cause of the disease, it is interesting to know that it is not always so fatal as carcinoma in other parts of the body. This circumstance is due to the fact that the malady is often of the epithelial kind, which, as was stated elsewhere, is generally much less malignant than true cancer, and, consequently, much more amenable to treatment.

The only reliable remedy for this disease is *excision*, performed early and freely, while the local mischief is still, as it were, in its infancy. All other treatment here is as unavailing as in similar disease elsewhere, the only benefit which it can afford being palliation. When

Fig. 334.



the tumor is superficial, and limited mainly to the prolabial surface, it may be removed by circumscribing it with an elliptical incision as in fig. 334, the edges of which are afterwards neatly approximated by the interrupted suture; the parts heal by the first intention, and the cure is followed by hardly any deformity. When the involvement is more extensive, embracing the entire thickness of the lip, ablation is effected by two incisions, one on each side of the tumor, extending from the prolabial margin down towards the chin, where they meet at an acute angle, like the lines of the letter V (fig. 335). Provided the resulting chasm is not very great, the raw edges



are placed in exact apposition, and retained by the twisted suture, as in the operation for hare-lip. The bleeding, which is sometimes considerable, is temporarily controlled by the finger of an assistant, and permanently by the contact of the abraded tissues. Occasionally it is necessary to cut away nearly the whole lip, and yet it is remarkable what little deformity is produced. In such cases, approximation is, of course, not sought for; the bleeding vessels are secured by ligature; and the gap is left to granulate, like a common suppurating wound.

6. *Eversion of the Mucous Membrane.*—This affection is peculiar to the upper lip, and may exist either as a congenital vice, as a consequence of simple hypertrophy from the habit of biting the part, or as a result of a preternatural elongation of the labial frenum. However induced, it presents itself in the form of a narrow horizontal fold when the individual laughs, and gives the part the appearance of a double lip, as in the adjoining cut (fig. 336), from one of my patients. The deformity is remedied by removing an elliptical portion of the lining membrane, along with some of the glandular structure, and tacking together the edges of the wound with the interrupted suture. The operation is best done with the scissors. If the frenum alone is at fault it should be duly abbreviated.

7. *Hare-Lip.*—Hare-lip is a congenital cleft, so termed on account of its supposed resemblance to the lip of the hare. It exhibits itself in several varieties of form, from the merest fissure to the most horrible and disgusting chasm. It may be single or double, simple or complicated. The relative frequency of these different varieties is not determined; but it is certain that they are sufficiently common, and they should, therefore, be studied with great attention. The upper lip alone is their seat, and they affect the left side much oftener than the right.

In the most simple form of the defect, there is merely a fissure in the lip, extending from its inferior border as far up as the gum; its edges, of which the outer is always more or less oblique, are rounded off, covered by mucous membrane, and of a florid red color. Their consistence is considerably greater

Fig. 335.

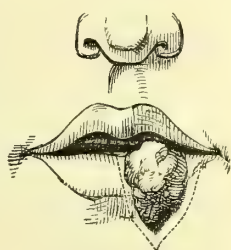


Fig. 336.



Fig. 337.



than that of the other labial structures, and, on being held together, they are seen to form, by their divergence below, a sort of triangle, the base of which corresponds with the free margin of the lip. In another class of cases the cleft is not only wider, but it extends considerably higher up, perhaps even into the nose, which, in consequence, is usually somewhat flattened at the side, as seen in fig. 337, from a clinical case. The jaw in this, as in the former variety, is entirely normal.

Fig. 338.



In double hare-lip (fig. 338) there are, as the name implies, two fissures, with an intermediate central piece, which varies much in size, shape, and direction, being sometimes broad and quadrangular, but more generally narrow, elongated, or mammillated. The framework of this part consists of two distinct portions, corresponding with the incisive bones of the inferior animals, and forming a rounded knob, connected by a narrow neck to the nasal septum. It is commonly very oblique, sometimes, indeed, almost horizontal, in its direction, is often very imperfectly covered by skin, contains the rudiments of the central incisor teeth, and almost invariably co-exists with cleft palate and deformity of the nose. The fissures bounding this knob

Fig. 339.



Fig. 340.



are not always of the same size and shape; on the contrary, one is frequently much wider, as well as longer, and more curved, than the other. They may both extend into the nose, or one may do so, and the other, perhaps, not reach higher up than the gum. Figures 339 and 340 represent the more common forms of the septum.

The *complications* of hare-lip are various, and deserving of attention.

One of the most simple is that in which the labial fissure is blended with a depression, prominence, or cleft in the alveolar process of the jaw-bone. The cleft may be partial or complete; in the latter case, it is generally, if not always, connected with flattening and deformity of the corresponding side of the nose, and, not unfrequently, also with fissure of the palate. In double hare-lip, the openings in the soft structures are almost always associated with malformation of the roof of the mouth. They pass round the central knob, at the posterior surface of which they become continuous with the palatine fissure, which generally extends both through the hard and soft parts as far as the extremity of the uvula.

Hare-lip is sometimes associated with other congenital malformations. I have witnessed its co-existence with club-foot, bifid spine, and scrotal hernia, and lately I saw an instance where, along with a horrible cleft in the palate, there was great deformity of the hands, one of which

was deprived of three fingers, and the other of one finger and the thumb.

Of the *causes* of hare-lip we are entirely ignorant. That it is a result of an arrest of development is certain; but how this arrest is produced is a circumstance in the history of foetal life which has not been satisfactorily explained. I am not aware that any statistics exist in regard to the relative frequency of the affection in the two sexes. In my own practice I have seen it nearly as often in one as in the other.

Hare-lip occasionally occurs in several members of the same family; and a case has been communicated to me by Dr. R. A. Lightfoot, of Maysville, Kentucky, in which this malformation has shown itself in four successive generations, mostly in its double form.

Hare-lip, besides being very unseemly, and, consequently, an object of constant attention and remark on the part of others, interferes materially with sucking, deglutition, and articulation. In the worst grades of the affection, as when the fissure is double, or associated with cleft-palate, it is often extremely difficult for the child to obtain the requisite amount of nourishment, much, if not most, of what is attempted to be swallowed regurgitating by the mouth. As he grows up, he finds himself unable to pronounce labial sounds, and thus, unless the defect is early remedied, his education must necessarily suffer, if, indeed, it be not entirely neglected.

The malformation under consideration can be relieved only by *operation*; and the question, consequently, arises at what period should it be performed, whether almost immediately after birth, within the first few months, or not until the child has attained the age of two or three years? There are few subjects in surgery which have been more frequently or more thoroughly discussed than this during the last quarter of a century. I am not certain, however, that the numerous controversies that have grown out of it have been of much benefit in settling the point; for my opinion is that, in practice, most surgeons are governed, in this matter, more by the results of their own experience than by the writings of their professional brethren. As in most other cases, so in this, the probability is that a middle course is the safest; at all events, it is the one which I have myself generally pursued, and thus far I have seen no reason to regret it. My opinion has long been that the most eligible period is from the third to the sixth month, or a short time before the appearance of the first teeth; the operation is then usually borne well, there is no danger of convulsions, and the adhesive process generally proceeds most kindly. In very simple cases, I do not hesitate to attempt it earlier; and, on the other hand, in double, or very complicated hare-lip, I almost always postpone it until the child has attained its second or third year. The operation for this variety of hare-lip is a very serious one; there must always necessarily be more or less loss of blood; the shock is frequently severe; and the resulting inflammation may be over-active; valid reasons, I conceive, for the exercise of caution and judgment. In the few cases in which I have performed the operation under such circumstances, the issue has been anything else than gratifying. It need hardly be added that, in an undertaking of so much



importance as this confessedly is, it is of vast consequence that the general health should be as good as possible; a feeble, irritable, or anemic state of the system is little favorable to the adhesive process.

The operation being determined upon, the child is wrapped up in a strong apron, in order to render it as passive and helpless as possible while its different stages are gone through with. If he be very young, he is placed upon the knees of an assistant, the head being nearly perpendicular, and held firmly by another assistant standing behind. Secured in this manner, he will not be likely to suffer any inconvenience from the bleeding, as the blood will not be so apt to flow into the throat. If he be very unruly, he may be put partially under the influence of chloroform, but the full effect of the medicine is never necessary.

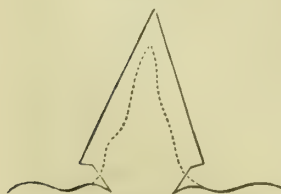
The operation, as it is usually performed, may be divided into three stages. In the first, the lip is extensively detached from the gums, sometimes as high up even as the nose, especially in bad cases. This I regard as a step of the greatest importance in regard to the form and beauty of the new lip, for so, in truth, it may be called. The second stage consists in paring the edges of the fissure, and the third in approximating them with the twisted suture. The instruments required are a narrow, sharp-pointed scalpel, a pair of scissors, forceps, a sponge-mop, and a few small pins with glass heads.

Everything being arranged, and the child firmly secured, the lip is carefully dissected off the gums, after which the edges of the fissure are pared with the same instrument, or, what will usually answer equally well, a pair of scissors. If the knife be used, it is inserted at the upper angle of the cleft and brought out at the lower, the surgeon cutting towards himself. In executing this part of the operation, the serious error is frequently committed of removing too little substance, in consequence of which, when the edges are approximated, there is an unsightly notch at the prolabial surface of the wound, which nothing short of another operation can efface. My invariable practice is to cut away the whole of the rounded portion of the fissure, and also, whenever there is a sufficiency of substance, to impart to the incisions a slightly curvilinear direction, so that the notch alluded to shall be effectually prevented, and the lip receive its proper length.

Malgaigne, with a view of preventing the prolabial notch, which is so apt to follow the ordinary operation, especially when carelessly

done, has proposed to pare the edges of the fissure in such a manner as to leave two angular flaps below, which, when brought together, shall effectually obviate the defect. The procedure will be readily understood by a reference to the drawing (fig. 341). If, when the parts are healed, the flaps should be found to be redundant, they can easily be retrenched with the knife or scissors. Professor March, of Albany, accomplishes the same object by means of a pair of forceps,

Fig. 341.



Malgaigne's operation. The dotted lines mark the fissure.

each blade of which terminates in a transverse jaw, convex at its free extremity, and serrated within, so as to secure a better hold upon the lip.

The hemorrhage attendant upon the paring of the edges of the cleft is easily controlled by the thumb and finger of an assistant, or by pressure upon the facial artery as it passes over the body of the lower jaw. If any blood falls into the mouth, it is at once removed with the finger, or a suitable sponge-mop.

The edges of the fissure having been thoroughly refreshed, or, more properly speaking, excised, are accurately approximated, and retained by the twisted suture, the only one which, in my judgment, should ever be employed in this operation. Three pins are generally required; they should be from an inch and a quarter to an inch and a half in length, according to the width of the gap, strong and well tempered, yet delicate, very sharp, and provided each with a glass head. The first instrument is inserted on a level with the red border of the lip, about three lines from the raw surface, and is brought out at a corresponding point on the opposite side, at least two-thirds of the thickness of the lip being in front of it. A strong silk thread, properly waxed, is then wrapped round the pin, not in the form of a figure 8, as is usually recommended in the books, but elliptically, as in fig. 342, and neither so firmly, on the one hand, as to create undue tension, nor so loosely, on the other, as to prevent perfect apposition. Another pin is passed, in the same manner, through the middle of the wound, and, finally, a third near its upper extremity, just below the nose. Sometimes two pins are quite sufficient, while, at other times, as many as four may be required. The pins having all been wrapped, the ends of the threads may be passed from one to the other across the interstices, being thus made to subserve the purpose of adhesive strips. All that now remains to be done is to cut off the point of each instrument with a pair of pliers, lest they should become entangled in the pillow, or the little patient hurt his hands. In performing this apparently trivial part of the operation, the surgeon makes moderately firm pressure on the centre of each pin, otherwise it may, if not well tempered, break in the substance of the lip, and thus necessitate the introduction of another.

No *dressing* is required after the operation. The part is kept cool and quiet, to insure adhesive action; and the child is fed with the spoon, the most suitable diet being milk, arrowroot, or chicken broth with soft-boiled rice. The upper and middle pins are withdrawn at the end of the second day, and the lower in twenty-four hours after. The threads, which soon become permanently glued to the lip by plastic lymph, are permitted to drop off spontaneously, as they often perform excellent service in maintaining apposition after the more efficient means have been removed. If any portion of the wound remain open, it is touched lightly with a pencil of nitrate of silver; or, if the gap be considerable, apposition is effected by the twisted

Fig. 342.



suture, as in the first instance. If the chasm is very large, additional support is furnished by carrying a long, and rather stout pin completely through the lip, at the distance of at least half an inch from the wound. Such a proceeding will be found to be much more efficacious than the use of an adhesive strip, stretched from one cheek to the other.

The operation for *double hare-lip*, although conducted upon the same principles as that for single, must necessarily vary according to the nature of the concomitant deformity. If the intervening piece is vertical, or nearly so, completely covered by skin, and of proper length, all that is required is to close the fissures in the usual manner; not, however, at one time, but after an interval of several weeks. If, on the contrary, it is very oblique, or almost horizontal, it must be removed. This may be done either with a pair of bone-nippers, a strong scalpel, or a small saw. Smart hemorrhage, from the division of the artery of the nasal septum, occasionally attends this stage of the operation, but, in general, soon ceases spontaneously, or with the aid of a little pressure with the finger. Should it prove troublesome, it may be necessary to touch the bleeding orifice with a heated probe, or to apply a graduated compress and roller. In the latter case, the paring of the edges of the now large and single cleft must be postponed until the child has recovered from the effects of the first operation. Removal of the intermaxillary septum in double hare lip is not unattended with danger. I have heard of at least one instance in which the operation occasioned death.

It has been proposed, in double hare-lip, to rectify the vicious position of the central piece by systematic compression, made either with the finger or a spring-truss, not unlike the instrument used in the treatment of umbilical hernia. In my own practice, however, I have seen no benefit from the proceeding, and I believe that it will generally be found inapplicable, or wholly inefficient. In removing this structure, great care should be taken not to encroach too much upon the nasal septum, otherwise the lip will be certain to have a flat and depressed appearance. Indeed, it is a good plan, in most cases, to retain a portion of it, for the purpose of supporting the soft parts; and this can always be easily enough done if the bone be divided perpendicularly through the alveolar process, the teeth, if any protrude, having been previously extracted. When the patient has reached the proper age, the piece thus retained can be easily retrenched, and the chasm filled with an artificial jaw. Another circumstance, not to be neglected where removal of the intermediate body is demanded, is to save a portion of its cutaneous covering; this should be properly shaped, and fastened, at the close of the operation, by several short, delicate needles, to the nasal septum, which it thus serves to render more prominent and seemly.

When the chasm is uncommonly large, as often happens when the intervening substance is removed, the tension of the parts may be so great as to require support; when this is the case the most suitable contrivance for the purpose will be found to be that sketched in the



annexed drawing (fig. 343). It was devised by Mr. Dewar, of Scotland, and is so arranged as to press each cheek over towards the middle line.

I had occasion, in 1849, to see a very singular case of hare-lip, which, so far as I know, is altogether unique in its character. The patient was a stout, healthy-looking boy, four years of age, son of a Mr. Preston, near Maysville, Kentucky. The cleft, which was congenital, occupied the left side of the cheek and the corresponding commissure of the mouth, being about one inch in length, by three-quarters in breadth. Its edges were rounded off, hard, red, and covered with

Fig. 343.



Dewar's compressor.

Fig. 344.



mucous membrane, just as in hare-lip. The child was unable to articulate distinctly, and experienced much difficulty in controlling his saliva, food, and drink, to say nothing of the disagreeable aspect which the fissure imparted to the features. The parts being pared in the usual manner, were approximated by three points of the twisted suture, and united beautifully by the first intention. The improvement of the face was most satisfactory. The annexed sketch (fig. 344) gives an accurate idea of the parts prior to the operation.

8. *Cheiloplasty*.—Extensive destruction of the lips sometimes occurs; generally as a result of malignant disease, accident, or sloughing from inordinate mercurialization, carbuncular inflammation, and other affections. The deficiency thus occasioned may generally be efficiently closed by an autoplasmic operation, performed upon the same principle as in making a new nose, the integumental flap being borrowed from the immediate neighborhood of the gap. When the upper lip is affected, the flesh is generally taken from the cheek, or partly from the cheek and partly from the neck. A similar procedure may be adopted when the outer portion of the lower lip is to be repaired, whereas, when the deficiency exists at its middle, the skin should be taken from the

chin, the incisions, if need be, being carried as low down as the hyoid bone.

After removal of the lip on account of cancerous disease, an excellent substitute may generally be made by raising two quadrilateral flaps from the lower part of the face and the upper part of the neck, by carrying an incision on each side obliquely downwards, beneath the jaw, from the base of the gap, and then obliquely upwards and backwards, some distance beyond the commissure of the lip. A triangular piece of skin is thus left at the middle line, the apex of which is directed upwards, and serves to mark the point of junction of the two flaps, after they have been dissected up, and stitched in place. The adjoining fig. 345 affords a good idea of the lines of incision, while fig. 346 exhibits the appearance of the parts after they have been united. The operation, which I have successfully performed in several instances, is usually known as that of Mr. Syme.

Fig. 345.

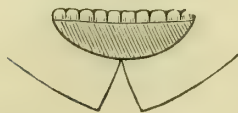
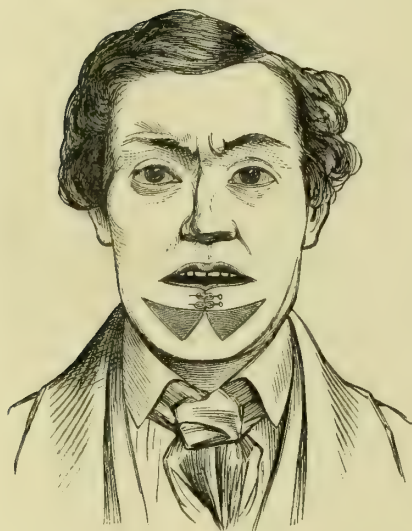


Fig. 346.



## SECT. II.—AFFECTIONS OF THE TONGUE.

The principal surgical affections of the tongue are wounds, inflammation, hypertrophy, carcinoma, and malformation of its frenum.

1. *Wounds*.—Wounds of the tongue are most commonly produced by the teeth during epileptic convulsions; but they may also be inflicted by balls, and by design with sharp instruments. The hemorrhage, which, from the great vascularity of the organ, is often copious, is to be commanded by ligature and styptics, unless it proceed from the posterior portion of the tongue, when it may be necessary to use the actual cautery. The edges of the wound are approximated by the interrupted suture, the only retentive means of which the parts admit; inflammation is kept in abeyance by antiphlogistics. Cases occasionally occur in which the tongue is almost completely severed, or in which the anterior extremity hangs only by a few shreds. Our duty obviously is to attempt to save the parts, not to cut them off; and with this view they are closely approximated by numerous stitches, thus placing them in the most favorable position for speedy reunion.

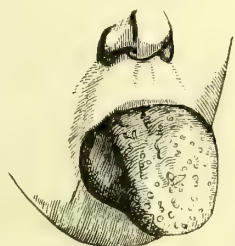
2. *Glossitis*.—Inflammation of the tongue, technically called glossitis, (fig. 347), of a severe character, is often caused by lacerated wounds, and by the contact of hot water, steam, and various kinds of acids. Not unfrequently the organ suffers secondarily, from extension of the disease in the surrounding parts, as the tonsils, palate, gums, and salivary glands. In common ptyalism, glossitis always exists; sometimes in a most violent degree. In the old method of treating syphilis, the tongue was often excessively inflamed, and so large as to protrude several inches beyond the teeth. However induced, the disease is frequently very severe, and productive of immense distress, from the great swelling and tenderness of the parts, and the attendant suffocative symptoms.

The patient is hardly able to talk or swallow, he pants for breath, and is an object of great pity. The tongue sometimes enlarges very suddenly, to a great and an alarming extent, almost completely filling the mouth, and occasioning excessive embarrassment in respiration. The cause of the attack, which occurs chiefly in middle-aged and elderly subjects, is generally inscrutable. In some of the reported cases it was apparently dependent upon the effects of cold, or a sudden suppression of the cutaneous perspiration combined with gastric disorder. The swelling is characterized by copious and rapid effusion of serum and lymph.

The *treatment* of glossitis is strictly antiphlogistic. If the patient is young and robust, blood is taken freely from the arm, the bowels are thoroughly evacuated, and the system is brought under the full influence of nauseants. The best topical applications are leeches beneath the base of the jaw, followed by large emollient poultices. Bleeding from the ranine veins is sometimes beneficial. In the milder cases the disease often promptly yields to astringent lotions and to counter-irritation to the neck, in the form of embrocations and ammoniated liniments. When the inflammation is of an erysipelatous character, the tongue may be painted several times in the twenty-four hours with a weak solution of iodine, or pencilled once effectually during that period with the solid nitrate of silver. When suppuration, gangrene, or asphyxia is threatened, deep incisions are made, to favor disorgement of the overloaded vessels and the escape of the effused fluids. The operation, although followed by what might appear to be an alarming flow of blood, is free from danger, and is the only remedy which, in such an event, is worthy of reliance.

The glossitis consequent upon *ptyalism* is often very painful and intractable; the tongue is generally much swollen, and of a fiery redness; patches of lymph form upon its surface, and not infrequently ugly ulcers make their appearance, thus adding greatly to the patient's suffering. The treatment consists in the daily use of mild aperients, warm applications to the head and neck, and astringent gargles, of which the best, according to my observation, is a solution of acetate of lead, in the proportion of two drachms of the salt to a pint of water.

Fig. 347.



Glossitis.



With this the mouth and throat should be freely gargled every hour, or even oftener, care being taken always to retain the fluid for a few minutes in contact with the affected parts. The only disadvantage of this gargle is that it discolors the teeth, an effect which, however, generally disappears in a few days after the discontinuance of the remedy, and which, considering its great efficacy, is really a matter of no moment. When the lead disagrees, or proves inefficient, weak solutions of sulphate of copper and tannin, sulphate of zinc, iodide of iron, or sulphate of alum may be employed as a substitute. When the tongue is very red and painful, ulcerated, or covered with lymph, the most suitable remedy, in general, is the nitrate of silver, drawn lightly over the affected surface once a day.

In the sudden and violent forms of glossitis, resulting from cold or gastric disorder, relief should be attempted by copious bleeding at the arm, speedily followed by an active emetic; the bowels should be freely opened, leeches applied to the chin and side of the jaw, and the tongue deeply scarified. If these measures fail, or there is impending suffocation, laryngotomy is performed.

3. *Ulcers*.—Ulcers of a syphilitic, strumous, mercurial, and simple character often exist on the tongue, and require much judgment on the part of the practitioner both for their discrimination and treatment. The history of the case, the habits of the individual, and various other circumstances will generally afford important information respecting the true nature of the malady. The simple ulcer is frequently associated with derangement of the digestive apparatus, and is usually easily distinguished from the other varieties of the affection by its superficial surface, by the slight discoloration of the adjacent parts, by the absence of induration, and by the readiness with which it yields to treatment. The syphilitic ulcer has a hard base, a foul, irregular surface, more or less discharge, and a copper colored appearance of the mucous membrane around, with great swelling, pain, and stiffness of the tongue. The strumous ulcer is not always easy of recognition, but its existence may be suspected when there is an obstinate sore on the edge of the tongue, near its centre, with a tumid state of the upper lip, an enlarged abdomen, and other evidences of the strumous diathesis.

The *treatment* of ulceration of the tongue is regulated by the nature of the disease upon which it depends. The syphilitic form is best managed by the exhibition of iodide of potassium, in combination with bichloride of mercury, and the application of nitrate of silver, or dilute acid nitrate of mercury. In strumous ulceration the chief remedies are cod-liver oil, and the different preparations of iodine, either alone, or in union with mercury. The mercurial variety generally requires no constitutional treatment, a cure being often effected in a few days by the topical use of nitrate of silver, sulphate of copper, acetate of zinc, and other astringent lotions. Similar means, especially the former, with attention to the state of the digestive organs, often succeed in the ordinary form of ulcer of the tongue. In all cases, whatever may be the nature of the exciting cause, the strictest attention should be paid to the diet, bowels, and secretions. This, indeed,

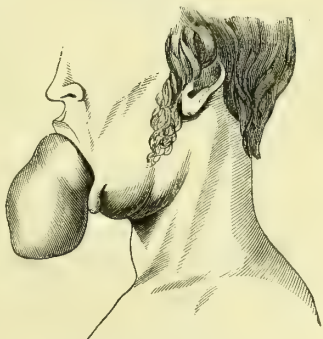
is frequently of itself sufficient to effect a cure, while without it no treatment, however well conducted, will be likely to be of much avail.

4. *Diphtheritis*.—A diphtheritic state of the tongue is sometimes observed. It is noticed most frequently in the latter stages of chronic diseases of a malignant or incurable character, accompanied with an anemic condition of the system. It is evidently of an inflammatory nature, and is nearly always associated with soreness of the fauces and pharynx. The tongue is usually somewhat tender and swollen, with a feeling of rawness, or a sense of scalding; and is covered with a thin layer of adherent lymph, of a whitish, grayish, or drab color. The crust sometimes extends over the whole surface of the organ, at other times it occurs in small spots, strips, or patches. The gums, cheeks, lips, roof of the mouth, and even the fauces occasionally participate in the deposit. On removing this substance, the mucous membrane is found to be somewhat rough, and heightened in color, with, perhaps, here and there a slight fissure, abrasion, or ulcer. A diphtheritic state of the tongue is occasionally produced by salivation.

The *treatment* of this affection is mildly antiphlogistic, the reliance of the practitioner being placed mainly upon local measures. Weak washes of sulphate of copper and tannin, with honey, nitrate of silver, and sulphate of zinc are generally sufficient to detach the diphtheritic crust and to remove the inflammation which causes it. Very frequently the best effects follow the employment of a strong gargle of biborate of soda, or the application of equal parts of this substance and of powdered sugar, aided by the exhibition of chlorate of potassa.

5. *Hypertrophy*.—Hypertrophy of the tongue may be limited to its muscular substance, to its papillæ, or to its mucous investment; or, as not unfrequently happens, all these structures may be affected simultaneously, as exhibited in the adjoining cut (fig. 348), constituting general hypertrophy. In the latter case, which alone concerns the surgeon, the organ is abnormally dense, rigid, and so large as to protrude considerably beyond the teeth, causing serious obstruction to the functions of the mouth, and a wasting discharge of saliva. The prolapsed part is from a few lines to three, four, and even five inches in length, by several inches in breadth and thickness, rough on the surface, preternaturally firm, and of a dark color. The papillæ are often five or six times as large as in the normal state, and the mucous covering has more of the character of bark than of sound structure. The affection, which is more common in females than in males, generally comes on early in life, being now and then, if indeed, not always, congenital. The exciting cause is unknown, though occasionally it is directly traceable to inflammation. It is sometimes associated with unusual short-

Fig. 348.



Hypertrophy of the tongue.

ness of the branches of the lower jaw, with great separation of the incisor teeth. Enlargements of this kind are often extremely vascular, from undue development of their minute vessels; and dissection shows that their muscular fibres are transformed into a pale, dense, fibrous substance, with hardly any trace of the normal structure.

The nature of this disease is always easily detected by simple inspection. Its progress is generally tardy, and free from pain and inconvenience, save what results from the bulk of the affected part. When this is considerable, the saliva dribbles constantly from the mouth, and the patient finds it difficult to articulate, chew, and swallow. The countenance has an unseemly aspect, the inferior incisors are forced into a horizontal position, and the jaw itself is not unfrequently considerably altered in its shape. The general health is remarkably prone to derangement, and a not uncommon symptom is disorder of the digestive apparatus.

Very little is to be expected from purely medical *treatment* in this affection, especially when fully developed. In the milder grades marked benefit occasionally follows regular and systematic purgation, low diet, and the exhibition of iodide of iron, iodide of potassium, or Lugol's solution. When the disease is of inflammatory origin, alterative doses of mercury may occasionally be advantageously conjoined with these remedies, but in the congenital variety little is to be expected from such a union. The most valuable local applications are leeches, punctures, or small incisions, and tolerably strong solutions of iodine, sulphate of copper, and other kindred articles. I have at present under my care a lad, aged six years, affected with congenital hypertrophy of the tongue, who has been materially benefited by lotions of pyroligneous acid, in the proportion of one drachm to the ounce of water. Under its influence the protruded portion of the organ has become much softer, as well as considerably reduced in volume. Lassus derived great benefit from systematic compression of the tongue by means of a bandage, and a case which was treated successfully upon this plan has recently been related by Professor Syme. If these means fail, the exuberant structures are removed by knife or ligature, as in carcinoma.

6. *Cancer*.—Cancer of the tongue usually exhibits itself in the form of scirrhus; encephaloid is extremely rare, and colloid is entirely unknown. The same is true of melanosis.

Scirrhus of this organ is most common in males after the age of forty, and generally arises without any assignable cause. The contact of a carious tooth or broken fang, and of the stem of the pipe in smoking, has been accused of originating it, but the idea is far-fetched and insusceptible of proof. The disease is most commonly situated towards the centre of the tongue, midway between the raphé and one of its edges, where it begins either as a minute, hard, and inelastic tubercle, a small fungous excrescence, or a little sore, chap, or fissure. However this may be, it gradually spreads, and at length degenerates into a foul, excavated ulcer, with indurated, jagged, and elevated edges. The parts around are hard and firm, and not unfrequently the whole organ is as stiff and immovable as a board. The



pain, which is sharp and pricking, or dull and aching, is particularly severe at night, and generally radiates about in different directions, especially along the cheeks, ears, and temples. Sometimes it is of a neuralgic character. The size of the affected organ is liable to much diversity; sometimes it is normal, but more commonly it is considerably augmented; and sometimes, again, it is a good deal diminished. In a case recently under my observation, it presented itself as a firm, hard, immovable mass, which accurately filled the trough formed by the dental arch of the lower jaw. At times the organ is so large as to project beyond the lips, and to encroach seriously upon the buccal cavity. Its color is usually somewhat heightened, and its edges are often indented by the teeth. As the malady advances, deglutition becomes embarrassed, from the fact that the food can no longer be collected and carried back into the throat; articulation is impaired; and sputation is performed with so much frequency and difficulty as to constitute a source of real suffering. By and by, the lymphatic ganglions at the base of the jaw enlarge; the gums swell, and exhibit a red, spongy aspect; the teeth loosen and fall out, and the system exhibits all the marks of the cancerous cachexia. Thus day by day the ruthless malady proceeds, until it has effectually accomplished its work of destruction. Sometimes other organs are involved in its progress, but most commonly the carcinomatous action is limited to its original site.

The *diagnosis* of carcinoma of the tongue can seldom be mistaken. The mode of origin of the malady, its slow, but steady progress, its resistance of treatment, the peculiar character of the resulting ulcer, the nature of the pain, the age of the patient, and the sure contamination of the adjacent parts, as well as of the general system, always serve to distinguish it from other affections incident to this organ.

The *treatment* of this affection has generally, at least until lately, been by ablation, either by the knife or ligature. The utility of such a proceeding, however, admits of great doubt, and my own opinion has long been that the less we interfere with the disease in this way the better. The results of experience are certainly strongly corroborative of this conclusion. The ordinary means for improving the general health, allaying pain, and preventing the spread of the disease are, of course, not neglected. These means are already familiar to the reader, and need not, therefore, be again mentioned. With judicious management, it is astonishing how long, in many cases, the disease may be kept in abeyance, and the final issue warded off.

7. *Erectile Tumors*.—The tongue is occasionally the seat of the erectile tumor. Its most common site is the anterior extremity of the organ, where it presents itself as a soft, elastic structure, of a bluish color, variable in form and size, free from pain, and subject to temporary enlargement under mental emotion. The affection is most frequent in young subjects, and is occasionally associated with similar developments in other parts of the body, as the lip and cheek. The tumor seldom acquires a large bulk, and, if seen in time, is readily amenable to treatment. The best application is the Vienna paste, used as in making an issue, only with more caution, the organ being drawn for-

ward and steadied the while by a vulsellum. Or, if the abnormal structure be limited and accessible, it may be removed by ligature, in the same manner as a carcinomatous tumor. Deligation of the lingual arteries has been practised, but with no encouraging results. In at least one case the operation was followed by fatal sloughing.

8. *Wart-like Excrescence*.—A wart-like excrescence sometimes grows from the tongue; generally from its sides or tip, of a red color, firm consistence, painless, benign, tardy in its development, and seldom exceeding the volume of a small pea, or raspberry. It is usually attached by a narrow pedicle, and is somewhat rough on the surface; its structure being of a fibroid character, intermingled with a

Fig. 349.



Epithelial tumor of the tongue, magnified 472 diameters.

large number of epithelial cells. The microscopical appearances of a growth of this kind, which I removed last January from a patient at the College Clinic, are represented in the adjoining sketch (fig. 349), by Dr. Packard.

The proper remedy for the wart-like tumor of the tongue is excision, or ligation, if there is reason to anticipate much bleeding. When small and recent, it generally yields very readily under the application of chromic acid.

9. *Cystic Disease*.—This affection of the tongue is rare. It consists, as the name implies, of serous vesicles, single or multiple, occu-

pying the muscular substance, and elevating the mucous investment in the form of little tumors, of a semi-transparent appearance, and occasionally quite sensitive. They vary much in size, but usually do not exceed the volume of a cherry-stone, and their number sometimes amounts to several dozens. Occasionally a solitary cyst, of considerable dimensions, is observed. The disease is of obscure origin, and not always easy of recognition. Indeed, it is only when the vesicles approach the surface that its true character can be indubitably established. In cases of uncertainty, the exploring needle should be used. The treatment is by incision, injection, or seton, according to the age and volume of the tumors.

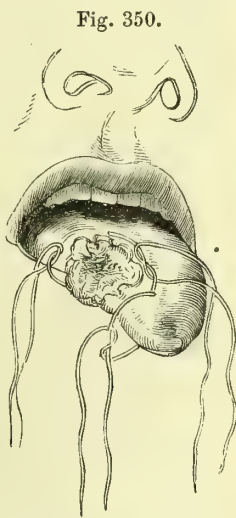
10. *Malformations of the Frenum*.—The tongue is sometimes restrained in its movements by malformation of its frenum, impeding, at first, suction, and, afterwards, articulation. The defect may consist in a short, indurated, and thickened condition of the part, or the little membrane may be prolonged so far forward as to interfere with the action of the tip of the organ; in either case demanding instrumental treatment. The operation, although simple, should not be performed wantonly, particularly as it is occasionally followed by hemorrhage. When necessary, the child's head is embraced between the knees of the surgeon, who,

elevating the tongue with the index and middle fingers of the left hand, carefully divides the frenum to the requisite extent with a pair of narrow-bladed scissors, the points of which are directed downwards, away from the ranine vessels, the great source of danger. The little patient is watched for some time after the operation, lest undue bleeding should ensue.

The frenum of the tongue is sometimes entirely absent, allowing the organ to fall back into the fauces, where, when the parts are quiescent, it looks like a fleshy tumor, attached to the pillars of the palate by a reflection of the mucous membrane. Bransby B. Cooper met with two cases of this kind in the same family. One of the children had died from suffocation, at the age of eighteen months, and the other had been repeatedly threatened with the same accident, the respiration being particularly embarrassed during sleep. When sucking, the muscles seemed capable of retaining the tongue in its proper position. In such a case, an attempt might be made, after paring the lower surface of the organ, to stitch it to the floor of the mouth, though it is not probable that the operation would be successful.

11. *Ablation of the Tongue.*—Ablation of the tongue is sometimes required. The operation may be performed with a knife or ligature, as may seem most expedient. If the affected part is small, and involves the anterior extremity of the organ, it may be included in two incisions, meeting behind at an acute angle, like the lines of the letter V. The edges of the wound are brought together by the common interrupted suture, which serves the double purpose of a retentive and hemostatic agent. If, on the other hand, the disease, from its remote site, is less accessible, a decided preference is given to the ligature, which, although more painful than the knife, is never followed by hemorrhage. A stout needle, slightly curved, fixed in a movable handle, and armed with a strong, double ligature, is passed through the tongue from below upwards, on the inner side of the tumor; the noose of the cord having been divided, one portion of it is tied forcibly in front, and the other behind, thus completely isolating and strangulating the diseased structure, as seen in fig. 350. In a few days the eschar separates, leaving an extensive ulcer, which fills up rapidly with granulations.

The remarkable feat of excising the whole tongue has recently been performed several times in Europe. Mr. Syme, of Edinburgh, has had at least two cases of the kind, both terminating fatally, from the effects of pneumonia. The operation, which has also been performed in France and Italy, consists in making a vertical incision in front of the neck, through the lip, as low down as the hyoid bone, in dividing the jaw at the symphysis, detaching the tongue from the inner surface of this bone, taking care to tie each bleeding vessel as it springs, and finally



Ligation of the tongue.



cutting away the organ from the hyoid bone. I have certainly not alluded to this operation with a view of recommending its adoption; on the contrary, it cannot be too strongly condemned. If there is any operation in surgery that deserves to be stigmatized as cruel and unmeaning, it is this.

### SECT. III.—AFFECTIONS OF THE SALIVARY GLANDS.

The salivary glands are not often the subject of disease or accident. Their protected situation and the peculiarity of their functions are, doubtless, the chief causes of this immunity.

#### PAROTID GLAND.

The principal surgical affections of the parotid are inflammation, abscess, and certain tumors, chiefly of a malignant character. Its excretory duct is occasionally the seat of earthy formations, of wounds, and fistules.

1. *Parotitis*.—Inflammation of this gland, as an idiopathic affection, is almost wholly confined to the young, constituting what is vulgarly called the mumps. It is sometimes seen later in life, and in a few rare instances it is witnessed in elderly persons. Being more common in males than in females, it generally prevails as an endemic, or epidemic, and, like most diseases of this class, seldom attacks the same individual more than once. It may occur at any period of the year, but winter and spring are its favorite seasons. Both glands usually suffer, though not always in an equal degree.

The disease commonly begins with some degree of stiffness in the temporo-maxillary articulation, which rapidly increases in severity, and thus materially interferes with mastication. The swelling is particularly conspicuous just in front of the ears, which are often seriously implicated in the morbid action, and is almost always attended with a good deal of pain and constitutional disturbance, without any local discoloration. In most cases, it extends down the neck and along the base of the jaw, imparting thus a singular expression to the features. As the inflammation progresses, the other salivary glands are apt to suffer; and, in the more aggravated forms of the disease, difficulty of deglutition is experienced, from involvement of the tonsils and arches of the palate. It usually reaches its height in about four days, when it begins to decline, and in a few days more terminates in resolution, rarely in suppuration or gangrene. A peculiarity of this variety of inflammation is its tendency to leave the organ primarily affected, and to fasten itself suddenly upon the testicle or mamma. How this transfer is established is utterly inexplicable by any known law of the animal economy, the more so as there is no connection, either direct or indirect, between these parts. It is most apt to occur in young men, at a period varying from a few days to a week from the invasion of the malady. A violent parotitis, liable to terminate in abscess, and even in mortification, occasionally follows erysipelas, certain forms of fever, as typhoid and scarlet, and the abuse of mercury.

Mumps is generally not a dangerous disease; but it may become so when it extends to the brain and testicle; in the former case, it may destroy life; in the latter, it may induce atrophy and loss of function of the affected organ. Several examples of the latter termination have fallen under my observation. When both testes suffer, impotence may be the result.

Parotitis seldom requires much *treatment*. In general, it is easily managed by rest and light diet, aided by aperients and diaphoretics, with warm applications to the affected parts. Sometimes a warm cataplasm promptly relieves the pain and swelling; at other times, great benefit is experienced from the use of slightly stimulating embrocations, as soap, iodine, or volatile liniment, with a thick covering of raw cotton. Cold applications should be carefully avoided, on account of their repellent tendency. In violent attacks, recourse is had to the lancet, or, at all events, to leeches, active purgatives, and antimonials. When much gastric disturbance exists, along with pain in the back and limbs, a brisk emetic will be useful. When the testicle is threatened by a translation of the malady, a blister should at once be applied over the parotid, in order to re-invite the inflammation. When the disease is fully established in the testicle, the usual antiphlogistic remedies are indicated, and should be employed without delay, lest structural lesion take place. Occasionally a good deal of hardness remains in the parotid region after the violence of the morbid action has disappeared. The proper way to meet this is to use stimulating embrocations and unguents, aided, in obstinate cases, by the constitutional effects of mercury.

2. *Abscess*.—Abscess of the parotid is nearly always of an acute character, being usually a result of simple inflammation, local injury, erysipelas, typhoid fever, smallpox, and other eruptive affections. The presence of matter is indicated by discoloration of the skin, circumscribed swelling, and high constitutional disturbance. The parts pit on pressure, the pain is excessive, and the patient is unable to open his mouth. Sometimes the swelling is remarkably diffused. The fluctuation is generally very obscure, on account of the manner in which the contents of the abscess are bound down by the cervical fascia and capsule of the gland. Owing to this circumstance, the true nature of the disease is apt to be overlooked, and the pus allowed to burrow about in different directions; thus producing the most serious mischief, opening, perhaps, after having induced the most violent suffering, into the auditory tube, or extending down the neck along the great vessels, and causing extensive havoc in the connecting cellular tissue. In some instances the fluid passes round the trachea, and finally destroys life by bursting into the chest. To prevent these disastrous effects, and to relieve the horrible pain which always attends the disease, an early and free incision should be made vertically into the most prominent, and also, if possible, into the most dependent, part of the swelling, and kept open by means of a tent until the cavity of the abscess is in great measure obliterated. The system, meantime, must be properly supported by stimulants and anodynes.

3. *Gangrene*.—Mortification of this gland occurs chiefly in erysipelas,

typhoid fever, scarlatina, and smallpox. Sometimes it follows violent salivation. Fortunately, however, it is very rare in any form of disease. The sloughing is usually most extensive in the connecting cellular tissue, but occasionally it affects the glandular substance also, which it may completely destroy, as I have had occasion to observe in several cases. In one of these not a vestige of the organ was left, its former site presenting a deep hollow, extending down to the ramus of the jaw and the auditory tube. When gangrene is impending, or has actually taken place, free incisions should be made, followed by the application of the yeast or port wine poultice, and appropriate constitutional means.

4. *Morbid Growths*.—Tumors of a fibrous, scirrhus, melanotic, and encephaloid character, are sometimes developed in the parotid, or in the cellular and adipose tissue enveloping it. In most cases they appear to originate in the lymphatic ganglions embedded in its substance, placed upon its outer surface, or situated in its immediate vicinity. The precise nature of the disease can rarely be determined by outward inspection, or manual examination. Such tumors usually grow rather slowly, but they are almost always accompanied by severe pain, from their pressure on the adjacent nerves; the deformity is great, sometimes hideous, and the patient is unable to masticate and open his mouth. In their volume they vary from that of a walnut to that of a foetal head. The largest are usually the encephaloid and melanotic, the scirrhus and fibrous rarely attaining much bulk. Their tendency is to destroy life, either by constitutional irritation, or by ulceration and profuse discharge.

These tumors, especially the encephaloid, occasionally show themselves at a very early period, and, in this event, they usually run their course with great rapidity, often destroying life in eight, twelve, or eighteen months. The scirrhus form is most common in elderly subjects, and is distinguishable by its extraordinary hardness, by its tardy progress, and by its comparatively small bulk. The melanotic tumor is, in general, easily recognized by its peculiar complexion, by its lobulated surface, and by its march, which is intermediate between that of scirrhus and encephaloid. It appears at various periods of life; but is most common in young adults.

5. *Extirpation*.—Considering the narrow space in which the parotid gland is situated, and the complexity of the relations which it sustains to the surrounding structures, is it possible to extirpate it in the living subject? This question, so interesting in every point of view, has been answered differently by different writers. Allan Burns thought the operation impracticable, and a similar opinion has been strenuously advocated by other authorities. Notwithstanding this, however, it has, undoubtedly, been repeatedly performed successfully within the last thirty years, as every one familiar with the history of surgery well knows. I should consider it great folly, therefore, in the present state of the science, either to doubt its possibility, or to deny its propriety. That the operation is difficult of execution, requiring the most accurate knowledge of the anatomy of the parts, and the most consummate skill, is certain, and unless the surgeon is fully possessed of these important



qualities, failure, if not disgrace, will be sure to attend his efforts. It should be added, however, for the encouragement of all, that it is much easier, in almost every instance, to remove a diseased than a healthy gland of this kind. In the former case, its fibrous envelop is usually so much condensed as to inclose and circumscribe the organ, rendering it thus perfectly distinct and separate; whereas, in the latter, it is a soft, ill-defined mass, which it is extremely difficult, even in the dead subject, to disengage from the surrounding structures by the most patient and cautious dissection.

In performing the operation, the patient lies upon a table, on the sound side of his face, with the head and shoulders well elevated. When the tumor is small, not exceeding the volume of an egg, a single incision, extending obliquely down in front of the ear from a short distance above the zygomatic arch of the temporal bone to an inch below the angle of the jaw, will usually afford sufficient space for our purpose; but in all other cases it should be crucial, elliptical, or T-shaped. The form of the incision, however, is of little moment, provided it is large enough to admit of free access to the diseased mass. The flaps having been dissected up in the usual manner, the tumor may next be lifted from its bed, either from above downwards, or, what is better, from below upwards. Whichever plan be adopted, the utmost caution is necessary in liberating the deep-seated parts, on account of the danger of wounding the internal carotid artery and the jugular vein, with their accompanying nerves. In executing this step of the operation, more reliance should be placed upon the handle of the knife than upon its point, which can hardly be employed, in a situation so deep, narrow, and full of important structures, without the risk of injury. When the connecting tissues are unusually soft or brittle, the tumor may be partly wrenched from its bed with the fingers; but such a proceeding is always objectionable, since it is liable to be followed by undue inflammation. The digastric muscle is frequently expanded over the tumor, and requires division.

The extirpation of this organ, for whatever object it may be undertaken, must necessarily be attended with loss of blood; but this is never, or, at least rarely, very great, if its dislodgment be effected from below upwards instead of in the opposite direction. By this procedure the external carotid will be exposed at an early stage of the dissection, and may, therefore, be readily commanded either by the finger or the ligature. I can see no reason for securing this vessel as a preliminary measure; for, in the first place, it is not always divided, and, in the second, the expedient is often impracticable on account of the great volume of the tumor. In the latter case, advantage might be derived from compression of the common carotid.

The removal of the parotid is always followed by paralysis of the corresponding side of the face, in consequence of the division of the motor branch of the seventh pair of nerves. The loss of power may last during life, or it may gradually disappear, at least in part. The resulting inflammation is generally severe, and requires the greatest vigilance of all concerned in the management of the case. The patient

may perish from the shock of the operation, from loss of blood, or from inflammation of the throat and larynx.

6. *Tumors over the Parotid.*—Tumors, principally of the nature of degenerated lymphatic ganglions, not unfrequently form upon and around the parotid gland. They often acquire a considerable bulk, and, enlarging in different directions, choke and compress the proper substance of the organ, thus causing it to waste and shrink. Excision, under such circumstances, may induce the unwary to suppose that the parotid has been removed, when, in fact, the morbid growth was altogether of an adventitious character. There is reason to believe that many, if not all, of the earlier operations practised upon this region were of this description. I have repeatedly extirpated diseased lymphatic ganglions from this situation. A few years ago, I removed a melanotic tumor from a gentleman of fifty-eight, which had attained the volume of a hen's egg, and required a very tedious dissection on account of its cystic structure, and its intimate relations with the surrounding parts. In extirpating morbid growths in this region, care should be taken to guard against injury of the branches of the portio dura, and also of the duct of Steno, the integrity of which should never be disturbed in any case whatever. The operation should be conducted upon the same principles as in excision of the gland itself.

7. *Affections of the Duct of Steno.*—This canal occasionally suffers in wounds of the face. The proper treatment is to put the edges of the divided structures in their natural relations, and to maintain them thus by several points of the twisted suture, aided by perfect quietude of the cheek. The object is to effect accurate parallelism between the two ends of the divided tube, and, when this is done, there is little danger of any untoward occurrence.

a. *Earthy concretions* are now and then met with in this tube. They are generally of an ovoidal shape, of a whitish color, rough on the surface, and composed of phosphate and carbonate of lime in union with a little animal matter. After having lain dormant for an indefinite period, their presence finally awakens severe pain, and sometimes even a great deal of constitutional excitement. In a case that was under my charge several years ago, in a man, aged thirty-nine, there was excessive swelling of the cheek, with a ridge-like elevation in the course of the excretory tube, and a diffused, erysipelatous discoloration of the skin. The parts were very hard and tender, the jaw was moved with extreme difficulty, and there was high inflammatory fever. Being satisfied that there must be a salivary calculus, I made a free incision into the orifice of the distended duct, on the inside of the mouth, but nothing followed, except a small quantity of a whitish, glutinous substance, intermixed with a few drops of pus. The concretion did not escape until the next day. The pain and swelling rapidly subsided, but for nearly six months the canal continued to be greatly distended, in consequence of the partial closure of its orifice, which required occasional puncture and dilatation to effect a permanent cure. When the inflammation caused by the foreign body is very severe, leeches, cataplasms, purgatives, and other anti-

phlogistic means are indicated. Extrusion is effected as soon as the diagnosis is established, by a free incision into the duct, on the inside of the mouth. Sometimes the calculus presses, as it were, through the orifice of the canal, and in this case the forceps take the place of the knife.

*b.* A *fistule* of the duct of Steno may be caused by wound, ulceration, abscess, or gangrene. Some of the very worst forms of the lesion that I have ever witnessed were produced by sloughing from pytalism. Such an occurrence is always to be deplored, inasmuch as it often involves great deformity of the features, and irremediable chasms of the soft substance. A fistule of this duct is not only unseemly and inconvenient, but it is attended with the loss of a fluid that plays an important part in the animal economy.

The principles of *treatment* are very simple, for they consist merely in changing the direction of the abnormal orifice, and in closing the fissure in the cheek. When the occurrence depends upon a recent wound, all that is, in general, required is the use of the twisted suture, and a compressing bandage; but if some time have elapsed, it becomes necessary, in addition, and as a preliminary step, to pare the edges of the opening, in order to place them in a condition favorable to the adhesive process. In fistule caused by abscess, ulceration, or suppuration, a cure may sometimes be effected by cauterizing the parts with nitrate of silver, acid nitrate of mercury, or a heated probe. A slight eschar is thus formed, and, granulations subsequently springing up, the saliva gradually resumes its natural channel. In the more obstinate forms of the affection, the plan suggested by the late Dr. Horner may be adopted, as holding out a fair prospect of success. It is both simple and easy of execution. The external orifice having been previously elongated a little in the direction of the zygomatic muscle, the head is supported upon the breast of an assistant, and a broad wooden spatula is introduced into the mouth, opposite to the site of the fistule. With a large, sharp saddler's punch the whole of the diseased structures, tube and all, are then removed, when the opening in the integuments is immediately closed with the twisted suture. Cold water-dressing is applied until the completion of the union, which usually happens in a few days. When the fistule is very large and obstinate, as when it depends upon a loss of substance, autoplasty may become necessary.

#### SUBMAXILLARY GLAND.

The submaxillary gland, from its protected position, and the manner in which it is isolated by the cervical fascia, is seldom the subject of disease. Of the malignant affections, to which, in common with the parotid, it is liable, scirrhus is the most frequent, though it is in reality extremely rare. The few cases in which it has hitherto been observed occurred in elderly persons, rather as a secondary than as a primary malady. In carcinoma of the lower lip, in epulis, and in cephaloma of the lower jaw, it occasionally becomes involved during the progress of the original disease, or after this has been removed by operation. Sometimes the gland becomes enlarged and indurated from interstitial



deposits, caused by the irritation of a tooth, cancer of the tongue, or disease of the surrounding lymphatic ganglions; but such an affection is very different from true scirrhus, and generally subsides with the cessation of the exciting influence.

Scirrhus usually begins in the form of a small, hard tumor, which gradually increases in size until it acquires the bulk of a hen's egg, or even of a large orange. It is slow in its progress, has an irregular surface, and is the seat of a constant darting, pricking, or lancinating pain. In time, the adjacent lymphatic ganglions enlarge, the gland contracts firm adhesions, the integuments ulcerate, and the general health declines, just as in scirrhus in other parts. When the tumor encroaches upon the mouth it interferes with speech and mastication, if not also with deglutition.

As the diagnosis cannot always be certainly established between this affection and simple enlargement of the gland, sound judgment imperatively dictates the propriety of a thorough investigation of the disease, and the removal, if possible, of all sources of irritation, before we resort to so serious an undertaking as an operation. If the enlargement and induration are the result of ordinary causes, the mildest measures will often be sufficient to effect a cure after attention to this circumstance. The removal of a carious tooth, or a dead piece of jaw, with a few doses of aperient medicine, will generally enable the gland promptly to regain its original characters. When the malady is malignant, excision alone promises any relief, but this, unfortunately, is seldom permanent. The operation necessarily involves the facial artery, and, therefore, requires some degree of dexterity. One incision, extended horizontally over the centre of the tumor, in the direction of the lower jaw, will generally suffice. The facial artery will usually be found at the posterior part of the diseased mass, and should always be tied before it is divided. By this procedure the operation is rendered almost bloodless. The sublingual artery and the hypoglossal nerve must be carefully avoided. In separating the gland from its deep connections, the finger and handle of the knife will afford good service. When the tumor is uncommonly large, the horizontal incision is intersected by a vertical one, the two representing the lines of the letter T.

Ordinary tumors, as enlarged lymphatic ganglions, occasionally require removal from this region. In general, they yield to antistrumous remedies, aided by proper regimen; but when they resist these measures, and give rise to serious symptoms, nothing short of excision will avail. Such an operation is usually sufficiently simple, requiring less skill on the part of the surgeon than anatomical knowledge. Sometimes the tumor is immovably fixed in its situation, and then, if it be of large size, a tedious and careful dissection becomes necessary. The course which I generally adopt is to make a horizontal incision along the base of the jaw, an assistant holding the facial artery out of the way with a blunt hook. In an operation of this kind, a few years ago, the vessel escaped the knife, but secondary hemorrhage ensued after the application of the dressings, apparently from one of

the nutrient branches of submaxillary. This was readily secured, and the patient soon recovered.

Several years ago, I met with a remarkable case of *cystic* tumor in the submaxillary gland, the patient being a middle-aged, married lady, the mother of several children. It had made its appearance about seventeen years previously, and was somewhat larger than a hen's egg; it was soft and fluctuating, free from pain, and unaccompanied by any enlargement of the subcutaneous veins. Upon being punctured, a thick, viscid fluid escaped, rendering it probable that it consisted merely of altered saliva. Had the patient been willing to submit to an operation, I should have evacuated the contents of the cyst, and injected it with a weak solution of iodine.

The *excretory duct* of the submaxillary gland, like that of the parotid, is not unfrequently the seat of calcareous concretions. They occur in both sexes, chiefly in middle-aged and elderly subjects, though the young are not wholly exempt from them. Their composition is phosphate and carbonate of lime, cemented together by a small quantity of animal matter. A calculus of this description of the left submaxillary gland, removed from a young Pole, is sketched in fig. 351. It is of a pyriform shape, rough, and of a whitish color; its length is upwards of one inch. Its presence was productive of a great deal of pain and swelling at the side of the tongue, attended, for several weeks, with inability to masticate, and excessive difficulty of swallowing. The diagnosis of the case was perplexingly obscure, until the concretion protruded at the orifice of the duct, from which it was finally withdrawn with the thumb and finger.

Fig. 351.



Salivary calculus.

# SUBLINGUAL GLAND.

The principal disease of the sublingual gland is *ranula*, a peculiar form of tumor caused by obstruction of its excretory ducts, and the retention of its peculiar secretion. The swelling seldom exceeds the volume of a pigeon's egg; but it may be so large as to encroach seriously upon the surrounding parts, impeding articulation and deglutition, pushing the tongue against the roof of the mouth, displacing the teeth, and bulging out underneath the chin. It has a grayish, translucent aspect, like the belly of a frog, whence its name; is of an irregularly oval shape, and contains a glairy, ropy fluid, like the white of eggs. Sometimes the contents are thin and watery, sometimes thick and pultaceous, and sometimes, again, of a yellowish, oily nature, similar to the synovial liquor of the joints. Particles of gritty matter, probably a mixture of phosphate and carbonate of lime, are occasionally interspersed through them.

Most of the cases of *ranula* that I have seen occurred in young subjects between the ages of eighteen and thirty. The disease, however, is not peculiar to this period of life. It is generally slow in its march, causes little or no suffering, and is unattended with derangement of the general health. These circumstances, together with its

singular appearance, and its situation beneath and by the side of the tongue, always serve to distinguish it from other affections. The croaking state of the voice is observed only in cases of long standing and large bulk, and, as it is liable to attend other diseases of the mouth, is of no diagnostic value. Where any doubt exists, it will be promptly dispelled by the introduction of the exploring needle.

It is not difficult to conceive how ranula is produced. It is essentially an encysted tumor. The orifices of the excretory canals of the gland being closed, either by direct adhesion, or by the interposition of some adventitious substance, the proper secretion, instead of passing off as fast as it is furnished, accumulates in the interior of the organ, causing, by its pressure, the absorption of a considerable portion of its substance, and thus forming a tumor which possesses all the properties just assigned to it. The retained fluid itself, as has been seen, undergoes most important changes.

The *treatment* of ranula must depend upon circumstances, as the age and volume of the tumor. In recent cases, it has been proposed to afford relief by removing the obstruction with a probe, frequently introduced into the orifices of the affected ducts; but all such attempts, if not futile, are exceedingly tedious and uncertain, and hardly worthy of trial. In my own hands, the most satisfactory results have uniformly attended excision of a portion of the sac, in the form of an oval flap, with a hook and a pair of scissors. The wound soon suppurates, and gradually heals by the granulating process. Some surgeons rely upon the seton; and lately it has been advised to inject the tumor with tincture of iodine, on the same principle as in hydrocele. Both methods are feasible, and usually effective. When the ranula is very bulky, or transformed into a solid, gristly mass, extirpation will be necessary, and it is well to know that the operation is, in general, neither difficult nor dangerous. A few years ago, I dissected out a growth of this kind, fully as large as a hen's egg, from the mouth of a young lady, who had long been the subject of paraplegia and dyspepsia. It was quite hard and solid, of a pale-yellowish color, not unlike a mass of fat, and was productive of no other inconvenience than what resulted from its bulk. Making a longitudinal incision along the side of the tongue, the flaps of mucous membrane were reflected to each side, when the tumor was easily enucleated with the handle of the scalpel. The parts speedily healed, and there was no return of disease.

The sublingual gland is liable to *calculous* formations, but the occurrence is extremely rare, and hardly deserves notice in a practical point of view. I have seen but one specimen of the kind, which I removed from a man, aged fifty-four, after it had caused, for several weeks, severe local distress, attended with great difficulty in moving the tongue.

*Carcinoma* of this gland is occasionally observed, possessing all the characteristic features of this disease as it occurs in other parts of the body. The affection is very uncommon, and I have seen only one case of it. The patient was a laborer, aged fifty-six, who had always



been in good health up to May, 1858, when he noticed a swelling on each side of the middle line, just below the tongue. When he came to the College Clinic the following November, the tumors were excessively hard, and the size each of a small almond; the pain was of a sharp, shooting character, and the movements of the tongue were much restrained. Excision being effected, a portion of the growth was subjected to microscopic inspection by Dr. Packard, who kindly furnished me the annexed sketch (fig. 352) of its minute structure. The disease reappeared in three weeks, and gradually extended to the gums and jaw, forming a large tumor, exhibiting all the external marks of scirrhus. The glands along the base of the jaw were enlarged, and the general health was becoming rapidly undermined.

Fig. 352.



Scirrhus of the sublingual gland. Magnified 472 diameters.

#### SECT. IV.—AFFECTIONS OF THE PALATE.

The principal surgical affections of the palate are wounds, inflammation, ulceration, and congenital deficiencies, analogous to those of the upper lip.

1. *Wounds*.—Wounds of the palate, both hard and soft, may be incised, lacerated, punctured, or gunshot, and usually exhibit the same phenomena as similar lesions in other parts of the body. Considerable hemorrhage is sometimes present, but this commonly ceases of its own accord, or is easily arrested by astringent lotions. When there is no loss of substance, and, consequently, little or no gaping, mere rest of the palate for a few days will generally be sufficient to effect a cure; when the reverse is the case, the interrupted suture may be necessary, the principle on which it is introduced being the same as in the operation for cleft-palate described below.

2. *Inflammation*.—Inflammation of the soft palate is usually associated with inflammation of the uvula and tonsils; it may be common or specific, and the treatment, consequently, must be modified according to the nature of the complaint. In the ordinary form of the disease, the principal remedies are purgatives, leeches to the neck, astringent gargles, and the application of the nitrate of silver; in the specific, these remedies are conjoined with constitutional treatment, embracing the milder preparations of mercury, and the iodide of potassium.

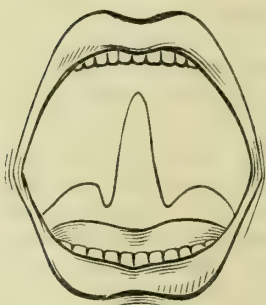
3. *Ulceration*.—Ulceration of the palate is generally dependent upon a syphilitic taint of the system. The sores, at first superficial, often

extend through the entire thickness of the curtain and arches of the palate, and usually exhibit a foul, unhealthy aspect, with a copper-colored appearance of the surrounding surface. The breath is fetid, the patient is obliged to clear his throat frequently of inspissated mucus, and there is derangement of the general health, with, perhaps, syphilitic eruptions of the skin, iritis, and other evidences of constitutional contamination. The diagnosis is determined mainly by the history of the case, and by the peculiar features of the ulcerative process. The treatment is decidedly constitutional; aided, if the patient be robust, by venesection and leeching. Excitement having been subdued, a mild course of mercury is instituted, and the sores are touched effectually once a day with the dilute acid nitrate of mercury, nitrate of silver, or sulphate of copper.

The hard palate may suffer in the same manner as the soft. The worst form of ulcer usually met with occurs in children and young persons, as the result of a strumous, syphilitic, or mercurio-syphilitic taint of the system. The patient looks pale and sickly, and the disease manifests an obstinate disposition to spread, sparing neither mucous membrane, fibrous structure, nor bone, which are often destroyed to a most serious extent. The mischief thus produced can frequently be repaired only by artificial means.

4. *Cleft-Palate*.—The palate is subject to congenital deficiency, analogous to hare-lip, and bifid spine, with which, especially the former, it not unfrequently co-exists. The defect occurs in various degrees, being sometimes very trifling, at other times exceedingly great. In the most simple form, which is, however, not the most common, it presents itself as a small, triangular fissure (fig. 353), extending through the uvula and the posterior portion of the velum, the remainder of the palate being perfectly natural. Sometimes, indeed, the uvula alone is affected. In a second series of cases, the cleft involves the whole of the soft palate, or this structure, and, perhaps, a part of the palate bone. In a third variety of form, both the soft and hard parts are deficient, the slit reaching from one end of

Fig. 353.



Cleft-palate.

the palate to the other. Fourthly, the cleft is occasionally associated with a cleft in the alveolar process of the maxillary bone, on one or both sides, and even with hare-lip. Finally, cases occur, though rarely, in which the hard palate alone is implicated.

The width of the gap, like its length, is subject to considerable diversity. Thus, it may not exceed a few lines, or it may be so great as to constitute a hopeless deformity. When it is limited to the soft palate it is always of a triangular shape, the base being below, and the apex above. When it involves both the soft structures and the roof of the mouth, it is generally of an oblong quadrilateral figure, the nasal septum extending along its centre, and dividing it, as it were, into two equal parts. The edges of the fissure, whatever may

be its size and form, are always rounded off, and of a firm, fibrous consistence, being often pared with much difficulty.

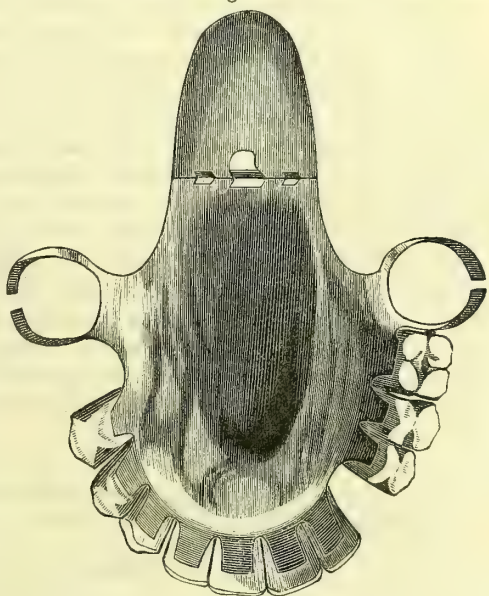
The *effect* of this condition of the palate, during infancy, is interference with suction and deglutition, and afterwards with mastication and articulation. The degree of the impediment is generally in proportion to the extent of the cleft. In the more severe forms, much of the food passes into the nose, where, causing irritation, it excites sneezing, inflammation, and even ulceration. From the imperfect control which such persons have over the muscles of the palate, both fluids and solids are very liable to descend into the windpipe. The speech is guttural and nasal, and frequently so indistinct as to render it, in great degree, incomprehensible.

The milder forms of this affection alone admit of cure by operation. When the gap is very wide, or extends the entire length of the palate and mouth, the only thing that can be done, in the generality of cases, is to recommend the use of an obturator, which, by closing the opening between the mouth and nose, will enable the individual to masticate and swallow with more facility, and also somewhat improve his speech. Such a contrivance, of which the annexed cut (fig. 354) conveys a sufficiently accurate idea, may be readily supplied, with or without teeth, by any ingenious dentist. Its great requisites are lightness and accurate adaptation.

When the case is a suitable one for surgical interference, the operation is not performed at once, but, instead of this, the patient is subjected to a course of preliminary training, to enable him to bear the necessary manipulations. With this view, the palate is frequently touched with the finger, or rubbed with a tooth-brush, probe, or spoon, until it no longer resents

the contact of the foreign body, but is perfectly calm and quiet under the most protracted procedure. This treatment may occupy several weeks, or even a longer time, depending upon the irritability of the parts, and the courage of the patient. But this, important as it is, is not all. Another point equally necessary, is the co-operation of the patient; without which, success will be entirely out of the question. The operation has occasionally been performed upon subjects under twelve years; but, in general, it is best to wait until after the age of fifteen. Even then it should not be attempted unless there is the

Fig. 354.





strongest reason to believe that the individual will be entirely passive during the perplexing and fatiguing ordeal to which he is obliged to submit. It is hardly necessary to add that, at the time of the operation, he should be perfectly well and free from cough.

The operation, technically called *staphyloraphy*, may be considered as consisting of three stages. In the first, the surgeon pares the edges of the fissure; in the second, he introduces the requisite number of sutures; and, in the last, he ties the ligatures.

The patient, sitting on a chair, with a firm back, his head is supported upon the breast of an assistant, and held in such a manner as to allow the light to fall in a full stream upon the palate. The jaws being widely separated, and the tongue duly depressed, either by the patient's own efforts, or by another assistant, the first stage of the operation is begun. The most suitable instruments, according to my experience, for seizing and paring the parts, are, a pair of long, slender forceps, and a knife similar to Beer's cataract knife, only much longer in the handle. If the fissure is very wide, as little of the edges should be removed as possible; but when the reverse is the case, a piece not less than a line in breadth is sliced off on each side. The knife is entered at the upper angle of the cleft, and drawn steadily downwards, until it cuts itself out below. The process is then repeated on the opposite margin, the forceps being employed, meanwhile, for putting the parts gently on the stretch. Some bleeding necessarily attends this stage of the operation, but this is commonly over in a few minutes, and should never be treated with astringents, as they have a tendency to impair adhesive action. A respite is now afforded, that the patient may recover from his fatigue, and regain his self-possession, which, although this part of the operation is neither painful nor protracted, is often severely tried.

The second stage of the operation consists in introducing the sutures, of which three, placed equi-distant from each other, are generally sufficient. If the refreshing of the edges of the fissure was troublesome, the arrangement of the sutures will be still more so. In truth, it may be regarded as the most difficult part of the whole procedure. It is executed with a needle, of the size and shape represented in fig. 355,

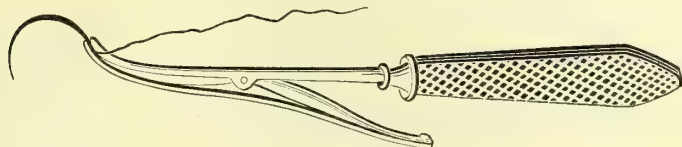
Fig. 355.



armed with a well-waxed silk thread, and held in the jaws of a pair of forceps, constructed for the purpose. The one which I am in the habit of using is here delineated, and is an unexceptionable instrument. The forceps of Schwerdt (fig. 356), if properly constructed, are also well adapted to the object. The first suture is introduced at the inferior extremity of the cleft, the needle being carried across from left to right, entering and issuing nearly a quarter of an inch from the abraded margin. The next suture is applied near the middle of the

gap, and the third within a few lines of the superior angle. During their introduction the palate is rendered somewhat tense by grasping the uvula with a pair of forceps, and as soon as the needle has trans-

Fig. 356.



Schwerdt's needle-forceps.

fixed the parts, it is seized at its point, drawn out, and reinserted into the instrument. The ends of each ligature are brought out at the corners of the mouth, where they are held by an assistant. When the patient is sufficiently docile, this stage of the operation is neither fatiguing, protracted, nor painful. The arrangement of the ligatures is exhibited in the annexed cut (fig. 357).

Fig. 357.

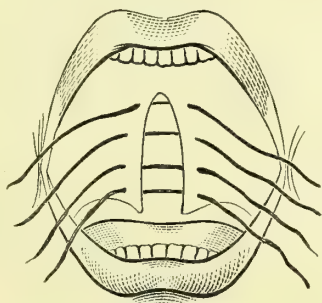
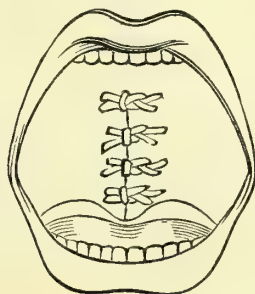


Fig. 358.



All that now remains to be done is to fasten the sutures, and this is, undoubtedly, one of the most delicate steps of the whole procedure. Taking hold of the long ends of the inferior thread, as they lie at the corners of the mouth, they are tied into a reef-knot, and cut off within a line of its surface. The other sutures are then secured successively in the same manner, the upper one being always tied last (fig. 358). If the ligatures have been well waxed previously to their introduction, they can generally easily be tied with the fingers alone, but when this precaution has been neglected, or the gap is inordinately wide, the loop may slip unless held with the forceps until the knot is completed. The same rules are adopted here in regard to the approximation of the edges of the fissure as in hare-lip; care being taken, on the one hand, that it is not too close, and on the other that it is not too slight.

In paring the edges of the fissure, as well as in the subsequent steps of the operation, the sponge-mop, depicted at page 523, will generally afford useful aid in clearing away blood and mucus. At least two such instruments should be at hand in every undertaking of the kind.

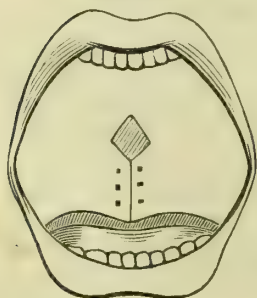
In most of the operations performed for the cure of this defect, it is

necessary, as suggested by Mr. Fergusson, to divide the palato-pharyngeal and elevator muscles, on account of the resistance which they offer to the approximation of the edges of the fissure. When the chasm is unusually large, or the irritability of the palate very great, this should always be done immediately after the process of abrasion; but under opposite circumstances it may advantageously be postponed until the stitching has been done, and in the more simple forms of the affection, it may, as I know from experience, be very properly omitted altogether. The division is easily effected with the knife used for paring the edges of the fissure, the parts being previously put, if necessary, on the stretch with a pair of forceps.

When the uvula is abnormally long it may be advantageously retrenched at the close of the operation; and occasionally I have found it convenient to stitch the opposite halves together, in order to insure their more accurate adhesion.

The operation being over, the patient sits up, or lies down, as he may find it most agreeable, absolute recumbency being rarely necessary. The great point is to keep the parts perfectly at rest; hence, talking, laughing, hawking, spitting, coughing, and sneezing, are to be most carefully avoided. The diet must be perfectly bland and simple, yet sufficiently nourishing; consisting entirely, until the adhesive process is pretty well advanced, of ice water, lemonade, thin custard, thickened milk, and soft jelly; not swallowed, but allowed to trickle down the throat, as often as the necessities of the case may seem to demand. If the resulting inflammation be so severe as to be likely to mar success, blood is taken from the arm, or by leeches from the base of the jaw, and the bowels are freely opened by enemata. The sutures are not disturbed as long as they appear to do good; generally they are not removed before the fifth day, and the inferior one often not until twenty-four hours later. If the union is imperfect, as evinced by the gaping between the sutures, either additional stitches are employed, or an attempt is made to effect closure by the repeated, but gentle application of the nitrate of silver. If it fail entirely, the operation is repeated, time being afforded the parts to recover from the shock and irritation of the first. Sometimes a small gap remains at the upper angle of the wound, which nothing can close (fig. 359).

Fig. 359.



Staphyloraphy was first performed by Roux, of Paris, early in the present century. Since then it has been repeated by numerous other practitioners, and now ranks among the established operations in surgery. In this country, the names of the two Warrens, Stevens, Hosack, Smith, Mettauer, Gibson, Mütter, Pancoast, and others, are honorably associated with it, either on account of their successful exploits, or their invention and application of useful instruments.

When the fissure involves the hard palate alone, it may occasionally be closed, provided it be very narrow, by dissecting up a flap of mucous membrane on each side, between the edge of the chasm and the



alveolar process of the jaw, and then stitching the parts together with several points of the interrupted suture, as in the ordinary operation. A similar procedure may be necessary when the roof of the mouth has been perforated by disease or accident. Upwards of twenty years ago I performed an operation of this kind upon a young gentleman, since deceased, with the most satisfactory results. The opening was fully half an inch in diameter, and the union was perfect in less than a week. Dr. J. M. Warren, to whom the credit of devising the operation is usually ascribed, has also performed it successfully. The nature of the procedure will readily be understood by a reference to the annexed cuts (figs. 360, 361), borrowed from Mütter.

Fig. 360.

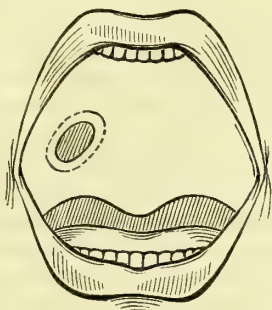
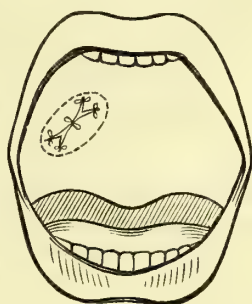


Fig. 361.



The acquisition of the power of speech after staphyloraphy is generally very slow; a circumstance of which the patient and his friends should be fully apprised beforehand, otherwise it may lead to sad disappointment and even reproach. Much may be done, in every case, by a regular, systematic course of training, persisted in, if necessary, for several years.

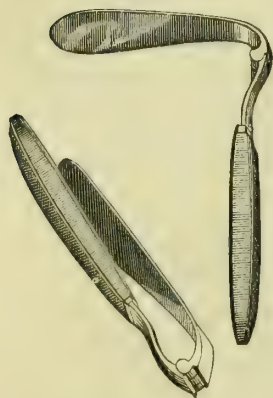
#### SECT. V.—AFFECTIONS OF THE TONSILS.

The diseases of the tonsils are few and simple, consisting mainly of inflammation and hypertrophy. Scirrhus and encephaloid have been noticed in them, but never, or, at all events, very rarely, as independent affections. In all the recorded cases of which I have any knowledge, they were associated with similar formations in other parts of the body.

To obtain a good view of these bodies, the patient is seated in a strong light, the mouth being opened as widely as possible, and the tongue depressed with a book-folder, a wooden spatula, the handle of a spoon, or, what I generally prefer, a common grooved director. In chronic disease, the latter instrument may be advantageously used for uncovering the affected parts, by lifting off the anterior arch of the palate, and also for ascertaining the degree of their consistence. Holding the tongue perfectly quiet, while the patient is taking a long inspiration, will bring the tonsils fully into view, and at the same time

prevent the unpleasant retching so liable to follow the contact of a foreign substance. When the tongue is unusually unmanageable, as it often is in children, and even in adults, the best depressor is the one represented in the annexed cut (fig. 362).

Fig. 362.



In acute, as well as in chronic affections, it is often necessary to bring our remedies in immediate contact with the tonsils, gargling, as it is called, being in most cases either ineffectual, or wholly inadmissible. The articles most commonly employed are the tincture of iodine and nitrate of silver, either in substance or solution. Lotions, of whatever description, should be applied by means of a mop, consisting of a piece of soft sponge, about four lines in diameter, and secured to the end of a thin cylinder of wood, eight inches long. The sponge being thoroughly wet, but not distended, with the fluid, and

the tongue depressed in the manner above directed, is passed down into the throat, and pressed gently, but effectually, against every portion of the suffering surface, not only of the tonsils, but of the uvula and the arches of the palate, which, as will presently be seen, generally participate in the disease. Solid substances, as sulphate of copper and nitrate of silver, are best applied in a long quill, or special carrier, the end being previously rounded off with a knife.

Scarification of the tonsils is occasionally performed for the relief of inflammatory engorgement. The operation is effected by drawing a sharp bistoury, guarded to within a line of its point, rapidly across the mucous membrane in half a dozen different directions. Discharge is encouraged by gargling freely with warm water. If clots form in the incisions, they are removed with the mop, finger, or director. Scarification of the tonsils and palate, although a favorite practice with some, has usually disappointed my expectations, and I, therefore, seldom employ it, except when there is inordinate œdema of the submucous cellular tissue. Even in such cases, however, more prompt relief will generally follow the application of the dilute tincture of iodine, or a strong solution of nitrate of silver. When the swelling is great and urgent, a few tolerably deep incisions will be advantageous.

1. *Acute Tonsillitis*.—Acute inflammation of the tonsils is exceedingly common, especially in young persons of a delicate, strumous constitution, and is often induced by the most trivial causes, of which the most frequent is exposure to cold. It occurs at all periods of life, in both sexes, and at all seasons of the year, being most common, however, in winter and spring. The attack is generally rather sudden, and is apt, if unchecked, to proceed with considerable rapidity. To a sense of soreness and stiffness in the throat, with a disagreeable, but indescribable feeling, which mark the stage of invasion, are soon super-added great difficulty of swallowing, severe pain, and a constant desire to clear the fauces of mucus, which is always very ropy, adhesive, and

abundant, and the effort to detach which constitutes a source of real suffering. The pain soon extends to the face, ears, and neck, and, the mechanical obstruction increasing, the breathing becomes much embarrassed, sometimes, indeed, almost to the extent of suffocation. If the patient attempts to drink, the fluid regurgitates by the nose, and often nearly strangles him; his head is thrown backwards, in order that the mouth and larynx may be brought more into a straight line; and, during sleep, he snores with a loud noise. The lymphatic ganglions, at the base of the jaw, are frequently swollen and tender; and there are few cases of any severity in which there is not high fever. On inspecting the mouth, which is often done with great difficulty, the tonsils are found to be very much enlarged, and of a deep, almost fiery red color, with here and there a speck, patch, or streak of firmly adherent lymph. From its peculiar color and shape, this substance frequently gives the glands an ulcerated appearance; but a careful examination soon serves to dispel the illusion. The arches of the palate, uvula, fauces, and root of the tongue, always participate in the morbid action, being red, tumid, and painful. Generally both tonsils are involved, though comparatively seldom in the same degree.

The *treatment* of acute tonsillitis is by antiphlogistics, early and vigorously employed, and persisted in until there is decided abatement of morbid action. When robustness of the system obtains, blood is taken by a large orifice from the arm, and by leeches from the neck, directly opposite the inflamed organs; the bowels are thoroughly evacuated; and, if there be much mechanical obstruction, a brisk emetic is administered. When the disease is very mild, or at its inception, prompt relief generally follows the use of the foot-bath, a full dose of Dover's powder, and the wet towel round the neck. In violent cases, besides the means already mentioned, scarification and even incision may be required, to remove tension and vascular engorgement. As to gargles, little reliance is to be placed upon any of them in any form of the disease, or in any of its stages, owing to the difficulty of bringing them in contact with the inflamed surfaces. When such remedies are indicated, it will always be better to mop the parts well with the dilute tincture of iodine, or to touch them very gently, with the solid nitrate of silver. The former application is particularly beneficial in the oedematous variety of tonsillitis, in which it often acts like a charm in relieving the mechanical obstruction caused by effused fluids. The proper proportions, except in young children and very delicate persons, are equal parts of the tincture and of alcohol. One application frequently suffices, but sometimes several are required, at intervals of ten or twelve hours. When the inflammation is diffuse and urgent, warm applications to the neck, in the form of thick cataplasms, will be serviceable.

When the tumefaction is very great, the tonsils may nearly fill up the fauces, and encroach so much upon the epiglottis as to interfere materially with respiration. In such an emergency, prompt relief must be afforded, or the patient may perish from suffocation. The plan to be pursued is to excise a portion of the affected glands at the middle line; or, this failing, to open the larynx. To let a man



die from such a cause is hardly less criminal than to kill him. If the operation be delayed too long, death may occur from the shock sustained by the system, in consequence of the struggles to maintain the respiratory functions.

2. *Gangrene*.—Gangrene of the tonsils is most frequently met with in connection with scarlatina, smallpox, and syphilis; as an event of ordinary inflammation, it is extremely rare. A fetid state of the breath, a foul, livid appearance of the affected glands, and a dark, sanious discharge from the throat, with difficulty of deglutition, severe pain, and high fever, are the characteristic symptoms. The surrounding structures, as the uvula and arches of the palate, usually participate in the mischief, exhibiting similar appearances, and augmenting the suffering. The treatment, as a general rule, is by stimulants; by brandy and quinine internally, and by the acid nitrate of mercury, nitrate of silver, or sulphate of copper locally. If the gangrene has been induced by syphilis, for which a course of mercury has been employed, the remedy is at once suspended, lest the destructive process be promoted instead of diminished.

3. *Ulceration*.—Ulcers, both common and specific, are liable to occur in the tonsils, or in these organs, the arches of the palate, and the mucous membrane of the fauces. The former are rare, and usually recognize derangement of the digestive apparatus as their exciting cause; they are small, irregular, superficial, and associated with a reddish, flabby condition of the throat, with a tendency to the formation of aphthæ or plastic deposits. Removal of the exciting cause, by purgatives and alterants, is generally sufficient for their cure; aided, if necessary, by light applications of the nitrate of silver. Of the venereal ulcer of the tonsils there are several varieties, as the excavated, the diphtheritic, and phagedenic; but as these have already been described, no particular account of them is required here.

4. *Abscess*.—Acute tonsillitis now and then terminates in abscess; the matter is seldom abundant, but often very offensive, and the symptoms are usually very urgent, from the mechanical obstruction caused by the inflamed and tumefied organs. The formation of pus is generally ushered in by an aggravation of the local and constitutional distress, as throbbing pain, livid discoloration of the mucous membrane, and rapid increase of swelling, together with rigors and high fever. On looking into the mouth, the tonsils, especially if both suffer in an equal degree, are found to touch each other at the middle line, leaving, perhaps, merely a small interval at their upper extremity, which is itself often nearly entirely closed by the enlarged and pendulous uvula. The patient breathes with immense difficulty, and appears as if he were in imminent danger of suffocation. The matter generally forms within the first five days after the commencement of the attack, and, in rare cases, even considerably earlier. It may form simultaneously in both glands, or be limited to one.

The *treatment* is rigorously antiphlogistic; and spontaneous evacuation, which might permit the matter to fall into the larynx, and so cause suffocation, is anticipated by early and free incision. A long, straight, sharp pointed bistoury, wrapped to within a third of an inch

of its extremity, is passed into the mouth, with the back towards the tongue, until it reaches the swelling, into the centre of which it is thrust with the requisite degree of force, the opening being afterwards enlarged to the desired extent by inclining the instrument over towards the median line. The head of the patient is held firmly by an assistant, lest he should push it forwards or to either side, and so endanger the internal carotid artery. For the same reason the knife is kept away from the angle of the jaw. In the natural state, the tonsil is at least five or six lines from this vessel; but when the gland is much tumefied the distance between them is sensibly diminished. Smart bleeding, from the division of the tonsillary artery, occasionally follows the operation, and is generally decidedly advantageous in allaying inflammation; it commonly ceases in a few minutes, and is always, if necessary, easily arrested by astringent gargles.

5. *Hypertrophy*.—Hypertrophy, or chronic enlargement of the tonsils (fig. 363), is exceedingly common, and is met with almost exclusively in young, strumous subjects. I have seen it repeatedly in children under three years of age, and in several instances that have fallen under my observation, there was every reason to believe that it was congenital, the affection having been noticed within a few days after birth. It rarely makes its appearance after the thirtieth year, unless it has existed earlier in life, and been only partially relieved. Old persons are entirely exempt from it. From its history and progress, it is obvious that it is always of a scrofulous nature. It occurs, at least so far as my experience extends, with equal frequency in both sexes.

The disease usually takes place slowly; and, although both glands are commonly involved, it is not often that they are both affected in the same degree. Generally speaking, they enlarge in every direction, and as they do so they encroach more or less upon the surrounding parts, as the base of the tongue, the arches of the palate, the larynx, and Eustachian tubes. Not unfrequently they touch each other at the middle line, leaving, perhaps, merely a small chink above and below for the passage of the air. Their color and consistence are liable to considerable diversity. In young subjects they are usually quite red, and so soft as to give way under the slightest pressure and traction. At this age I have occasionally met with a peculiar foliaceous arrangement of the gland, its substance being spread out in distinct strata, of a red color, very vascular, and remarkably friable. In cases of long standing, and, indeed, as a general rule, the organs are of a bluish, pink complexion, and of a tough, firm consistence. At other times, again, although this is rare, they are almost of scirrhus hardness. Their follicles are ordinarily much enlarged, and often contain plugs of lymph, inspissated mucus, curdy matter, or cal-

Fig. 363.

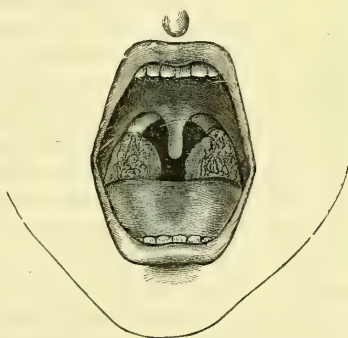


Fig. 364.



Hypertrophy of the tonsil.

careous concretions. When the orifices of these little bodies are very patulous, they impart to the surface of the hypertrophied tonsil the appearance of the lid of a pepper-box, as seen in the drawing (fig. 364), from a clinical case. The shape of the gland is generally irregularly elongated, but now and then it is almost globular. The uvula, the arches of the palate, and the mucous membrane of the fauces, almost invariably participate in the diseased action.

It is questionable whether the tonsils would ever become chronically enlarged, or, at any rate, whether they would remain long in this condition, if there were not always a constitutional predisposition to it. It has already been remarked that the affection is of a strumous character, and it certainly does not, in the present state of pathological science, require any proof to demonstrate the fact. The experience of every practitioner furnishes daily illustrations of its truth. When this predisposition exists the slightest exciting cause, as exposure to cold, suppression of the cutaneous perspiration, and derangement of the digestive apparatus, will be sufficient to produce an attack of the disease. The frequent recurrence of the act maintains and re-excites the inflammation and the effusion of lymph, which are the immediate causes of the enlargement and induration from which the affection derives its distinctive features. Whether there is often, or ever, any deposit of tubercular matter in the interstices of the hypertrophied organs has not been demonstrated; but that the enlarged follicles occasionally contain a substance of this description, or of one very closely resembling it, the results of my examinations abundantly attest.

Enlargement of the tonsils, unless considerable, is not necessarily attended with any unpleasant symptoms; the only inconvenience experienced being, perhaps, a sense of fulness and occasional soreness in the throat. These effects are always aggravated whenever the patient takes cold, or labors under derangement of the general health. In the more confirmed forms of hypertrophy, however, the local suffering is always proportionably great, being such as necessarily arises from the mechanical obstruction from the enlarged glands. The voice is husky, nasal, and disagreeable; the respiration is impeded; and there is an uneasy feeling in the throat, with a remarkable tendency to inflammation. When the tonsils are so large as almost to approach each other at the middle, the distress is greatly aggravated. During sleep a low moaning is usually present, accompanied with snoring and stertorous breathing, and the head is strongly retracted, so as to bring the mouth on a line with the windpipe, evidently for the purpose of facilitating the ingress of the air. In cases of very long standing, distortion of the features is apt to arise; the nostrils are habitually dilated; the mouth is half open; and the whole countenance has a dull, vague expression. Partial deafness, from obstruction of the Eustachian tube, occasionally exists; and the chest is liable to become arched behind, flattened in front, and contracted at the sides. This deformity is sometimes present in a surprising degree at an early period.



of life. I have seen several well-marked examples of it in children under six years of age.

A great variety of means have been tried for arresting the progress of this affection, and for promoting the absorption of the interstitial deposits of the glands, so as to restore them to their primitive condition. Very few of them, however, are found to have the desired effect, especially when the disease is fully established. The remedies most worthy of reliance are iodine and other kindred articles, administered internally, and applied to the affected parts. The tincture of iodine, with an equal quantity of alcohol, and a weak solution of the iodide of iron, applied once every other day by means of a soft mop, are both valuable sorbefacients, and may occasionally be used with advantage. The nitrate of silver is also beneficial, especially in its fluid form. The proper strength, in children, is from fifteen to twenty grains of the salt to the ounce of water; in adults, at least double that. Numerous and repeated punctures with the point of a delicate bistoury have sometimes been attended with good results in my hands: they serve to disgorge the capillary vessels, and to promote the absorption of effused lymph; two most important indications in the treatment. Lately frequent compression of the enlarged gland with the finger has been suggested; but the trials that I have made with it have disappointed my expectations. With these means may be conjoined, sometimes with advantage, the application of leeches, embrocations, and stimulating unguents to the neck. In all cases, due attention is paid to the state of the general system; the diet is carefully regulated; the bowels are maintained in a soluble condition; and, when there is any evidence of debility, tonics, especially iron and quinine, are freely exhibited.

The above treatment failing, as, unfortunately, it is too apt to do, the only way of getting rid of the enlarged bodies is to excise them, or, rather, a considerable portion of them, in order to enable the air to enter the lungs with its accustomed freedom. The operation performed with this view, consists in seizing each gland with a double hook (fig. 365), and cutting off all that part of it which lies exterior to the arches

Fig. 365.



of the palate with a curved, probe-pointed bistoury (fig. 366). The instrument is carried from below upwards, with the back towards the

Fig. 366.



tongue, excision being effected almost in an instant, with hardly any pain or hemorrhage. The hook and knife, with which it is my custom

to perform the operation, and which are here represented, are altogether superior to the tonsillotomes of Physick, Gibson, Fahnestock, and other surgeons. They are each about eight inches in length. The great objection to the tonsillotome is that the ring, at its distal extremity, is rarely sufficiently large to receive the hypertrophied gland in its embrace, so as to allow us to cut off as much as is necessary. In

Fig. 367.



Fahnestock's tonsillotome.

children I have occasionally used the instrument with excellent effect. The neatest tonsillotome is that of Fahnestock, represented in the annexed cut (fig. 367). When both tonsils require removal, and the surgeon is not ambidextrous, the operation may be performed very easily with the right hand.

*Excision* of the tonsils is easy enough in the adult, but in the child it is often attended with immense difficulty, on account of his cries and struggles. Indeed, there are few operations which, under such circumstances, are more annoying and perplexing than this. To overcome this difficulty the best plan is to wrap up the child firmly in an apron, and to have him well supported by assistants; or, what I prefer, to administer a small quantity of chloroform, just enough to produce partial insensibility. In this manner one tonsil being removed, the little patient is allowed time to clear his throat, when, the agent being again inhaled, the operation is completed by excising the other. The best depressor of the tongue is the surgeon's index finger. The interposition of a piece of cork between the teeth is an awkward and unnecessary proceeding.

The operation above described, although generally free from hemorrhage, is not so always. In 1849 I performed it upon a boy, aged eleven years, in whom the bleeding was not only copious, but absolutely alarming. Both tonsils were much enlarged, and were accordingly excised; the right bled hardly any, but from the left the blood issued from numerous points, and was spat up every few seconds in large mouthfuls. Much also was swallowed, and afterwards ejected by vomiting. The entire quantity amounted, I am satisfied, to nearly twenty ounces. The boy, although for a short time very pale, feeble, and nauseated, soon recovered from the effects of the operation. The remedies used for arresting the hemorrhage were, first, sulphate of copper, and afterwards powdered alum, applied freely by means of a sponge-mop, ice to the neck, and a full dose of laudanum, with thorough elevation of the head, and exposure of the body to a current of cold air. The lad slept well the following night, without any recurrence of the bleeding. There was no evidence of a hemor-

rhagic diathesis. An equally remarkable case of bleeding from excision of one of the tonsils fell, many years ago, under the observation of my friend and former colleague, Professor Cobb, in a youth of fourteen. The portion of gland removed did not exceed the volume of a pigeon's egg; but the flow of blood was so copious as almost to induce syncope. When the hemorrhage proceeds from the division of the tonsillary artery, it may be necessary, in the event of the failure of styptics, to seize and compress the bleeding orifice with a light pair of forceps, retained temporarily in the mouth.

Prudence dictates the propriety, after removal of the tonsils, of confining the patient for several days to a moderately warm apartment; at all events, he should avoid the cold air, and, if necessary, on account of the severity of the resulting inflammation, he should take an active cathartic. For want of this precaution several lives have been lost that might otherwise have been saved.

6. *Serous Cysts*.—The tonsil is occasionally, though very rarely, transformed into a serous cyst, filled with a thin, watery fluid, or a thick, ropy substance, resembling the white of eggs. The tumor is usually small, and may be suspected to exist when the gland has a whitish, translucent appearance, with a sense of fluctuation on the application of the finger. No pain attends its formation, and the only inconvenience which it produces arises from its mechanical obstruction. The treatment is by incision, followed by the application of nitrate of silver.

7. *Chronic Abscess*.—The chronic abscess, as it is termed, sometimes forms in the tonsil, as a result, evidently, of the strumous diathesis. In the few cases in which I have seen it, it occurred in young persons, in association with tuberculosis of the lungs. The abscess, which is usually very tardy in its progress, and free from pain, seldom exceeds the volume of a pigeon's egg, and may generally be easily recognized by the whitish, grayish, or drab color which it imparts to the surface of the gland. Its contents are characteristic. The proper remedy is free incision.

8. *Malignant Disease*.—Scirrhus and encephaloid have been observed in these bodies, but so rarely as hardly to deserve even passing notice. They always co-exist with similar deposits in other organs, pursue the same course, are characterized by similar phenomena, and are equally uncontrollable by treatment. Surgical interference is justifiable only when the gland acts obstructingly to respiration and deglutition, with a hope of very brief amelioration. I am not aware that melanosis or colloid have ever been witnessed in this situation; certainly not as independent affections.

#### SECT. VI.—AFFECTIONS OF THE UVULA.

The principal affections of this body are acute inflammation and chronic enlargement. In the former, which frequently co-exists with acute disease of the tonsils and palate, the organ is swollen, and of a fiery red, or pale ash color, elongated, and oedematous. Its free ex-



tremity is sometimes expanded into a kind of watery bag, which, if there be at the same time great tumefaction of the tonsils, often alarmingly obstructs the respiration, and necessitates the promptest interference. The treatment consists in touching the part effectually with the dilute tincture of iodine, nitrate of silver, or powdered alum and capsicum. When the enlargement is excessive, or decidedly œdematous, scarification may be required, or even excision of the free extremity of the organ.

The uvula, from debility, inflammation, and other causes, is liable to chronic enlargement, especially elongation. The elongation varies in extent from the slightest increase of the part to several times the normal length. I have repeatedly seen it amount to an inch and three-quarters, and in some rare instances, it has been known to exceed these dimensions by six or eight lines. An increase of length is usually associated with an increase of thickness; but this is by no means necessarily the case, for an elongated uvula is occasionally remarkably narrow and tapering. Chronic enlargement of this organ may occur at any period of life, but is most common in young and middle-aged subjects, and is generally the result of repeated attacks of cold, operating upon a delicate and feeble organization. It is frequently conjoined with inflammation of the palate, tonsils and fauces, with derangement of the digestive apparatus and a strumous diathesis.

Very disagreeable effects may be produced by an elongated uvula. Thus, the affected organ may project down into the rima of the glottis, occasioning aphonia, or a change in the tone and power of the voice, and a sense of strangulation. I recollect one case where the patient had repeated attacks of nightmare from this cause, which were promptly cured by excising a portion of this organ. The more common effects, however, are obstinate and protracted cough, with frequent desire to clear the throat, titillation of the fauces, dryness of the mucous membrane, and a feeling of constriction and frequent hawking. When the affection continues long, tubercles sometimes form in the lungs, and the patient ultimately dies under all the symptoms of confirmed phthisis.

The uvula is occasionally productive of disagreeable effects from mere relaxation of the soft palate, independently of any particular disease of its own substance. The palate, thus affected, hangs down into the fauces, and thereby permits the organ to infringe upon the larynx and root of the tongue in the same manner as in real elongation. Such a state of things is very common in dyspeptic and consumptive subjects, in whom it often constitutes a source of great annoyance.

The proper remedy for this affection is *excision* of the uvula. All astringent lotions, washes, and gargles, are perfectly useless, and, therefore, no time should be wasted in their employment. The patient sitting upon a chair, opposite a good light, the surgeon depresses the tongue, and with a pair of polypus-forceps seizes the apex of the uvula, which is then cut off with a pair of probe-pointed scissors, slightly curved upon the flat. Not more than about one third of an inch of the organ should be left, otherwise the elongation may be re-induced at some future period, and so demand another operation. In a few instances I have removed nearly the whole of this body, without, so far

as I could discover, producing any injurious effects of any kind. It has been asserted that, when the excision is performed near the base of the uvula, there will occasionally be a serious change in the voice, but of this I have never seen an example. If I were obliged to operate upon a professed singer, I should certainly limit myself to the removal of a very small portion of the elongated organ, lest unpleasant consequences of this nature might arise. The operation, as above advised, is so simple that any one may perform it. No hemorrhage, properly so called, need ever be looked for, nor is the excision attended with any pain. The diet for the first few days must be chiefly liquid, and care should be taken that the patient do not take cold.

#### SECT. VII.—AFFECTIONS OF THE PHARYNX AND ŒSOPHAGUS.

The affections of these two tubes, which, in point of structure and function, are intimately associated, may be conveniently considered together. The most common and important of them are, inflammation, abscess, wounds, strictures, malignant growths, and foreign bodies.

1. *Pharyngitis*.—Inflammation of the pharynx occasionally exists as an independent affection; but, generally speaking, it is associated with, or a consequence of, disease of the palate and tonsils. It may be the result of ordinary causes, as suppression of the cutaneous perspiration, or the lodgment of a foreign body; or it may be induced by the syphilitic poison, by a strumous taint of the system, or by the contact of an erosive substance, as nitric, sulphuric, or hydrochloric acid. The inhalation of steam, and the swallowing of hot water are often followed by intense inflammation, both of the pharynx and œsophagus.

The *symptoms* of the disease will be more or less urgent, according to the violence and duration of the morbid action. Impediment in deglutition, a frequent desire to clear the throat, and a copious secretion of thick, ropy mucus are, in general, the most conspicuous phenomena. In the more severe forms of the disease, the patient often experiences severe pain and spasm, especially in his attempts to swallow liquids, which frequently regurgitate by the mouth and nose; the voice is hoarse and croaking; and there is occasionally not a little embarrassment in the breath, from an extension, apparently, of the inflammation to the windpipe. Considerable swelling, chiefly of a glandular nature, sometimes exists in the neck, along the base of the jaw, and in the gutter below the ears. The lining membrane of the pharynx is of a deep-red color, its follicles are much enlarged, and its surface is covered with thick, ropy mucus, and, here and there, even with plastic matter. In severe cases, the inflammation extends up into the nose, forwards over the palate, and down into the larynx. The constitutional symptoms vary with the intensity of the local action, and need not, as they exhibit no peculiarities, be described.

The *treatment* is antiphlogistic; by the lancet and antimonials, if there be much local and constitutional excitement, by purgatives, diaphoretics, and anodynes, and by leeches to the neck, with tepid, acidulated gargles, and scarification, especially if the inflamed surface

be within reach, and by the application of the nitrate of silver, either in substance or strong solution. When the tube is loaded with ropy mucus, attended with a frequent desire to clear the throat, great relief will follow an emetic. Warm applications to the neck, in the form of poultice or fomentation, and the inhalation of the steam of warm water, are occasionally beneficial. If gangrene be threatened, the parts are promptly and efficiently touched with nitrate of silver, or, what is preferable, a weak solution of the acid nitrate of mercury.

2. *Abscess*.—An abscess, generally of a strumous nature, occasionally forms in the upper part of the pharynx, beneath the mucous membrane in front of the cervical vertebræ, which are often involved in the morbid action. The disease is generally very stealthy in its mode of invasion, and tardy in its progress, there being commonly an entire absence of the usual symptoms of inflammation. The first thing, perhaps, that attracts attention is slight impediment in deglutition and breathing, with an inclination to snore, and to sleep with the mouth open. Upon looking into the throat, a tumor is detected, bulging forwards into the fauces, of a reddish, livid, or purplish color, irregular in form, and imparting a distinct sense of fluctuation under the pressure of the finger. The matter is of a scrofulous character, and everything about the disease is denotive of this peculiar action. In the advanced stage of the affection, there is often caries of the superior vertebræ, and ulceration of their connecting cartilages. The contents of this variety of abscess occasionally disappear spontaneously, under the influence of sorbefacient remedies, or nature's unassisted efforts; but, in general, they require to be let out artificially, and the sooner this is done the better, as their long retention cannot fail to exert an injurious influence upon the surrounding parts. To perfect the cure, a course of antistrumous treatment should be instituted, and persisted in until the desired object is attained.

A *phlegmonous abscess* sometimes forms in this situation, giving rise to violent local distress, as well as severe constitutional disturbance. The symptoms are bold and well marked. The pain is deep seated and pulsatile, the parts are red and intensely inflamed, the difficulty of swallowing is very great, the breathing is much embarrassed, and the patient is unable to lie down. The swelling, which is easily seen and felt, should be punctured at the earliest possible moment to prevent death from suffocation, which, if the case be neglected or misunderstood, will be almost certain to happen from the pressure of the matter upon the glottis or its sudden escape into the air-passages.

3. *Diphtheritis*.—There is a form of inflammation of the pharynx to which the term *pseudo-membranous* is applied, as it is characterized by the deposition of plastic matter upon the free surface of the mucous membrane. It is very common in certain localities of Europe, particularly at Paris, where it often prevails as an epidemic, sometimes spreading over considerable districts. It is supposed by many to be infectious, inasmuch as it now and then runs through entire families; and is most frequently met with in weakly, ill-fed children, between the second and tenth year. As an accidental disease, it is occasionally noticed in smallpox, scarlatina, measles, and typhoid fever.



The plastic matter appears either as a continuous membrane, spread over the surface of the pharynx, or in the form of patches, of variable size and shape. However this may be, it is of a grayish, whitish, or pale yellowish color, of a tough consistence, and more or less firmly adherent. It seldom consists of more than one thin layer. When the inflammation is violent, the lymph frequently extends upwards over the tonsils and palate, downwards into the œsophagus, and forwards into the larynx. Under such circumstances, too, it is occasionally of a dirty drab color, or cineritious appearance, from the admixture of sero-sanguinolent secretion. The deposit is usually preceded, for a day or two, by slight fever, and often extends with great rapidity. The subjacent mucous membrane, which furnishes it, is deeply injected, thickened, and of a deep scarlet color: in the more severe forms of the malady, it is softened, ecchymosed, rugose, and ulcerated, the lymph lying, perhaps, in immediate contact with the denuded muscular fibres of the part. The mucous follicles are uncommonly large and well developed; the tonsils are softened, tumid, red, and infiltrated with various fluids; and the submaxillary glands and the lymphatic ganglions of the neck often sympathize in the morbid action.

The *treatment* of this affection, especially in its endemic forms, is very uncertain, and the consequence is that many of those who are attacked with it die. The most reliable remedies, particularly at the commencement of the disorder, are gentle emetics and purgatives, followed by diaphoretics, and calomel, carried to the extent of slight ptyalism. As local applications, the most efficacious articles are acid nitrate of mercury, hydrochloric acid, and nitrate of silver, all in strong solution, employed once or twice in the twenty-four hours. The chlorate of potassa has been a fashionable remedy in the disease, but its effects have seldom been encouraging. Tonics, as quinine and milk punch, are generally required to sustain the strength. Change of air often proves highly beneficial.

4. *Wounds*.—Wounds of the pharynx and œsophagus, already incidentally treated of elsewhere, are always serious accidents, on account of the importance of the functions of these tubes, and their complicated relations with other structures, which are liable to be injured at the same time. They may be transverse, oblique, or longitudinal, as it respects their direction, and incised, lacerated, contused, or gunshot, as it respects the nature of the vulnerating body. Their existence, which is commonly sufficiently evident, is always, in cases of doubt, easily determined by the escape of ingesta in eating and drinking. Whenever they are accessible, or can be rendered so by a proper enlargement of the external opening, their edges should be approximated by the interrupted suture, carried through the entire thickness of the tube, and placed at intervals not exceeding the fourth of an inch. The ends are tied into a double knot, and cut off close to the surface of the wound, to afford the loops an opportunity of falling into the passage, and thus descending into the stomach. That this is the most certain and rational method of managing these injuries is sufficiently evident from analogy and observation, and it is only surprising that it has hitherto been so seldom adopted.

5. *Stricture*.—Of stricture of the œsophagus—for the affection rarely occurs in the pharynx—there are two varieties, the spasmodic, and the organic.

a. *Spasmodic stricture* of the œsophagus is altogether a very singular disease. It is most common in nervous, excitable girls, soon after the age of puberty, though I have repeatedly witnessed it in very young children of both sexes. Old maids and married women about the decline of the menses, are also particularly prone to it. It is produced by a great variety of causes, of which disorder of the uterine functions, derangement of the digestive organs, and spinal irritation are the most common. It is often intimately associated with hysteria, recognizing the same origin, and forming merely, as it were, one of the complications of that Protean affection. Instances have occurred in which it was produced by the irritation of hemorrhoidal tumors, the removal of which promptly cured the disease. The characteristic symptoms are, severe pain in the œsophagus, or in the œsophagus and pharynx, a sense of constriction as if a cord were drawn firmly round the chest, great difficulty or utter impossibility of swallowing, embarrassment of breathing, and intense mental anxiety, with a feeling of impending suffocation. The attacks often come on suddenly and unexpectedly, and occasionally they disappear in the same mysterious manner; their intensity and duration are subject to much diversity, being now mild and short, now severe and protracted. Cases occur in which the disease manifests a periodical tendency, coming and going very much like a paroxysm of intermittent fever.

The *treatment* of this disease must be regulated according to the nature of the exciting cause, which should, therefore, always be carefully inquired into. The general health is amended by suitable means; the bowels are constantly maintained in a soluble condition; the secretions are corrected and restored; spinal irritation is removed by leeches, cupping and vesication; and proper attention is paid to the diet, exercise and other hygienic measures. Most patients will be immensely benefited by systematic purgation, by chalybeate tonics, either alone or in union with quinine, by the shower bath, and by gentle exercise in the open air. During the attack, relief is attempted by anodynes, assafoetida, valerian, and the compound spirit of ether, sinapisms to the spine, the warm bath, and the passage of the probang, which often acts like a charm, removing the pain and suffering almost in an instant, obviously upon the same principle as the bougie does in spasmodic stricture of the urethra.

b. *Organic stricture* of the œsophagus is rare. It may occur in any portion of the tube, but its most common site is just below the cricoid cartilage, or near the junction of the œsophagus and pharynx (fig. 368). It is seldom that more than one stricture of this kind is observed in the same person. The immediate cause of the disease is inflammation, whether produced spontaneously, by external injury, by hot water, or by the contact of acrid substances, as alkalies and acids. Most of the cases that I have met with have occurred in subjects under thirty years of age; but it is liable to arise at all periods of life, and is

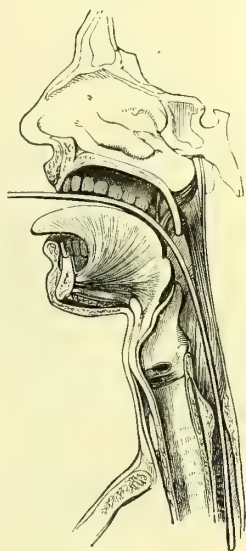
equally common in both sexes. I am not aware that occupation engenders any predisposition to the disease.

If a dissection be made of a person that dies of organic stricture of the œsophagus, it will be seen that the principal seat of the malady is in the lining membrane and the submucous cellular tissue, which are unnaturally hard, firm, and resisting, and of a grayish, whitish, or slightly bluish appearance. It is only in the more aggravated cases that there is any serious involvement of the muscular fibres. The contraction may be limited to one side of the tube, or it may embrace its entire circumference, which, in fact, is most common; in its depth it varies from a few lines to several inches. The degree of obstruction ranges from the slightest diminution of the caliber of the tube, to almost complete occlusion, as in organic stricture in other mucous canals. The œsophagus, immediately above the seat of the coarctation, is usually dilated into a kind of subsidiary pouch, which, in severe cases of long standing, is sometimes capable of containing from six to ten ounces of fluid or ingesta. The mucous membrane is generally somewhat attenuated, occasionally opaque and thickened, and, now and then, even ulcerated. The portion of the canal below the stricture is commonly normal.

The *symptoms* of this disease are not, at first, characteristic, being usually such as are denotive only of impeded deglutition, with a sense of uneasiness in the neck, chest, or precordial region. As the disease progresses, the patient finds it more and more difficult to swallow both solids and fluids, but especially the former, which are often arrested in considerable quantity just above the stricture, from which they either gradually descend into the stomach, or they are at length ejected by vomiting, or, more properly speaking, by regurgitation. Not unfrequently the deglutition is suddenly interrupted by spasm of the part, which compels the patient to desist from further efforts, until the action has subsided. At times, again, he suddenly experiences a sense of suffocation, attended with a feeling of constriction in the chest, palpitation of the heart, and great mental anguish. When the malady is fully established, there is always serious disorder of the digestive apparatus, as flatulence, acid eructations, and constipation of the bowels; the flesh and strength decline; the countenance has a wan, sallow, pinched appearance; the extremities are habitually cold; the surface is easily impressed by atmospheric vicissitudes; and the poor sufferer, a prey to the worst forebodings, at length dies completely exhausted.

The *diagnosis* of organic stricture can be determined only by a thorough exploration with the bougie, of which one of gum-elastic is the best. In the absence of such an instrument, however, a piece of

Fig. 368.



Stricture of the gullet, at its most ordinary site. A bougie shown introduced by the mouth.



whalebone, surmounted with a short cylinder of ivory, may be used as a convenient substitute. The head being thrown backwards against the breast of the surgeon, so as to bring the mouth on a line with the fauces, the bougie is carried down to the obstruction, the precise seat of which is thus at once ascertained. To determine its consistence, it is only necessary to note the degree of resistance offered to the passage of the instrument; if this be slight, it may be inferred that the stricture is slight also, and conversely. To obtain a definite idea of its extent, both longitudinal and peripheral, the bougie is carried, not only into, but through the stricture.

Organic stricture of the œsophagus is generally a very obstinate and intractable disease, setting at defiance the best directed efforts of the surgeon for its relief. In particular is this the case when it has been caused by loss of substance, as a wound, ulceration, or gangrene, or when it has been the result of high inflammation occasioned by the contact of an acrid substance, as an alkali or acid. The affection is also, in general, more difficult to cure in the old than the young, and in such as have been injured by previous disease, intemperance, and other kinds of indulgence, than in those of a healthy, robust constitution.

As this disease consists essentially in a deposition of plastic matter in the mucous and submucous tissues of the œsophagus, the principles of the *treatment* will easily be understood. The leading indication, of course, is the removal of this substance, so as to afford the parts an opportunity of regaining their normal caliber, consistence, and resiliency. First of all, the general health must be amended, for this is usually considerably deranged, by attention to the diet, bowels, and secretions. In this manner is laid the foundation for the more successful operation of the remedies, local and constitutional, to which the more immediate office of removing the abnormal deposits is confided. This preliminary treatment need seldom occupy more than ten, twelve, or fourteen days. At the end of this period a slight course of mercury is commenced, either in the form of the iodide, mild chloride, or bichloride, the choice of the article being influenced by the peculiar features of each case. Very slight ptyalism is encouraged, and persistently maintained for several weeks. Concurrently with this treatment the bougie is used, at first once every fourth day, then every other day, and finally every day, the instrument being retained, if possible, a few minutes at each introduction, and its size gradually increased as the stricture yields under the dilating process. Much caution is necessary in both these particulars, lest further effusion instead of absorption take place. Cauterization with nitrate of silver may be necessary when the parts are unusually irritable, but, in general, it should be avoided; it is best performed by means of an instrument constructed on the same principle as that used for the urethra, and moved about in such a manner as to bring the substance as gently as possible in contact with every portion of the affected surface. In very obstinate cases, depending upon the presence of an inordinate quantity of fibroid, or fibro-cartilaginous tissue, scarification might be employed, but such an operation should never be undertaken without great care

and deliberation. Restoration of caliber being effected, the labor of the patient and surgeon is not ended; on the contrary, vigilant supervision of the general health is steadily maintained, and the insertion of the bougie is repeated at gradually increasing intervals until all danger of relapse is safely passed.

6. *Carcinoma*.—Malignant disease of these tubes usually presents itself in the form of scirrhus (fig. 369), commencing as an infiltration in the submucous cellular tissue, and gradually extending to the other structures, especially the mucous. Encephaloid is exceedingly rare, and of colloid, I am not aware that any example has ever been met with. The most common site of the heterologous deposit is the œsophagus just behind the larynx, but it may occur in any portion of the canal, and occasionally, though very rarely, it has been known to occupy the pharynx. Old persons are most prone to this disease, and females suffer more frequently than males. The symptoms which accompany this malady are those of dysphagia, attended with pain, and a sense of constriction in the chest. The swallowing becomes more and more difficult, and at length even liquids can hardly be forced across the obstruction. The pain is usually of a sharp, pricking, lancinating character, and darts about in different directions, up towards the head and fauces, down towards the stomach, and back towards the spine. The flesh gradually wastes, the countenance exhibits a sallow, cadaverous aspect, obstinate hiccup supervenes, and the patient, worn out by protracted suffering, finally perishes from inanition. In some instances, especially when ulceration is present, life may be destroyed by hemorrhage; while occasionally, again, though this also is very rare, the fatal event is produced by the escape of ingesta into the windpipe, the mediastinum, or the pleuritic cavity. The causes of carcinoma of the pharynx and œsophagus are similar to those of malignant growths in other parts of the body. The diagnosis can, in general, be early determined by the history of the case and by a thorough exploration of the affected parts with the bougie. The ulcer-

Fig. 369.



Carcinoma of the œsophagus.

Fig. 370.



Ulcerated scirrhus of the œsophagus.

ated form of scirrhus of the œsophagus is well represented in fig. 370, from a specimen in my collection.

The treatment, of course, is palliative; the strength is sustained by nourishing broths, taken by the mouth or rectum, and pain is allayed by anodynes.

7. *Polyps*.—The pharynx and œsophagus, especially the former, are occasionally, though very rarely, the seat of polyps, similar to those in some of the other mucous outlets. The most common variety is the pedunculated, the tumor being attached, as the name implies, by a narrow footstalk, sometimes of extraordinary length, while its body, which is usually pyriform, lies loose in the interior of the tube. When situated high up, it is sometimes projected into the fauces and even into the mouth when the patient coughs or retches, and by this circumstance alone the disease can commonly be readily distinguished from other growths. Dysphagia, from mechanical obstruction, of course, exists when the tumor is large, but the general health remains good much longer than in scirrhus, the progress of the malady is comparatively tardy, and there is always an absence of cancerous cachexia. When the morbid mass becomes fixed the diagnosis will be more difficult, and its decision will then hinge mainly upon a correct appreciation of the history of the case.

The structure of these tumors is still involved in obscurity. In the most common form of the affection, however, it is of a cellulo-fibrous nature, soft, inelastic, and of a reddish color, not unlike that of a cherry. Small straggling vessels generally ramify over its surface, and are apt to give way under rude manipulation, furnishing thus occasionally quite a smart hemorrhage. The proper substance of the tumor itself, however, is not very vascular, and hence it rarely bleeds much during removal.

If the polyp be within reach, it may generally be readily seized with the forceps, and twisted off at its point of attachment to the mucous membrane. In case it is situated a considerable distance down the tube, removal may be attempted in the same manner, but in this event it will be necessary to employ a longer instrument, and one that is curved somewhat on the flat; or, instead of this, the growth may be noosed with a silver wire, passed by means of a double canula, and broken off by gentle rotation of the tube, aided by cautious efforts at extraction. Unless their base is very broad, or their seizure very imperfect, few tumors of this kind would be likely to resist such a procedure. Failure, however, is possible, and then, provided the polyp be situated in an accessible part of the tube, œsophagotomy might be necessary.

8. *Paralysis*.—Paralysis of these tubes is sometimes met with, chiefly in old persons affected with palsy of other parts of the body. The characteristic symptom is simply dysphagia, without mechanical obstruction, and, consequently, without any impediment to the passage of the bougie. The disease is usually of unfavorable import, especially when of gradual accession, and the result of organic lesion of the brain, or of the brain and spinal cord. When the attack is sudden, as when the paralysis is induced by apoplexy, or external violence,



the danger is not so great, and ultimate recovery may, in many cases, be reasonably hoped for. The treatment is regulated by the nature of the exciting cause, and does not, therefore, admit of specific detail. In the more chronic forms, our chief reliance is placed upon systematic purgation, gentle, but persistent ptyalism, iodide of potassium, strychnine, and counter-irritation of the dorso-cervical portion of the spine, by blister, issue, or moxa. When the strength is much reduced, electricity, the shower-bath, either cold or tepid, the use of the flesh brush, tonics, and other invigorating measures will be required. Until the œsophagus has regained its muscular powers, the requisite amount of food and drink must be introduced into the stomach by means of an elastic tube.

9. *Foreign Bodies*.—Foreign bodies are liable to lodge upon the root of the tongue, between the arches of the palate, in the mucous follicles of the tonsils, around the mouth of the larynx, in the pharynx, and in the œsophagus. They generally consist of fish and chicken bones, a crust of bread, fragments of the kernels of fruit, pins, needles, bits of meat, cartilage, or tendon, pieces of coin, and other analogous substances. In cleaning the teeth, the bristles of the brush often fall out, and become entangled in the throat. In fact, substances of every form and character are liable to be arrested in these passages, and it is only surprising, when we consider the complex structure of the fauces, that accidents of this kind are not more common. Whatever may be their nature, their presence usually awakens a considerable degree of uneasiness, if not of actual pain, with a sense of soreness, and a frequent desire to swallow and clear the throat. Occasionally there is a marked increase of the salivary secretion, an abundant flow of ropy mucus, and an alteration of the voice, which is hoarse and guttural. If the foreign body remains for any length of time, inflammation will be almost certain to take place, and may run so high as to induce the greatest distress, and even endanger life.

When the extraneous body is of large size, and impacted in the lower part of the pharynx, or in the upper extremity of the œsophagus, a prominent symptom will be difficulty of breathing, caused by spasm of the glottis. When the pressure is very great, or long-continued, suffocation may take place in the same manner as when a foreign substance is lodged in the windpipe. Desault mentions a case in which a woman lost her life in three minutes from strangulation, occasioned by the impaction of a piece of bone in the middle of the pharynx. Many similar examples are recorded.

Clearance is attempted as early as possible after the accident, with the finger, forceps, or emetics, according to the exigencies of each particular case. If the intruder be within sight, it may often be reached with the finger; or, this failing, it may be extracted with a pair of polypus-forceps, the tongue being previously depressed with an appropriate instrument. When this organ is unsteady, or absolutely rebellious, quietude is first insured by the inhalation of a moderate quantity of chloroform. Not a little trouble is sometimes experienced in finding the extraneous substance, especially when it is very diminutive, or when it is lodged in one of the mucous follicles of the tonsils,

between these bodies and the arches of the palate, or in the pouches at the root of the tongue. When this is the case, a thorough exploration is made with the finger, aided with a grooved director, a long probe, or a large spoon, with a long, slender handle, with which the parts are pushed gently asunder, and exposed to light. Should the attempts at extraction fail, relief is sought in emetics, of which the most prompt and efficacious are alum, ipecacuanha, and mustard, their action being promoted by large draughts of water, during the regurgitation of which the intruder is often safely ejected. It should be remembered, as a circumstance of great practical moment, that, although the foreign body may have been expelled, yet the irritation

Fig. 371.

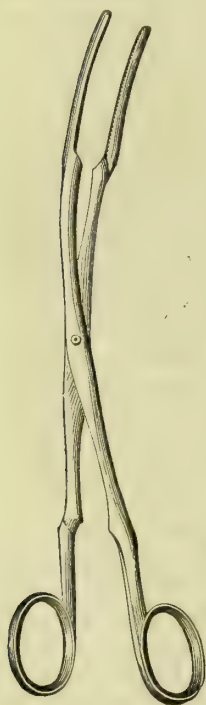


Fig. 372.



awakened by its presence often remains for a considerable time after, thus inducing the impression in the mind of the patient that he is still unrelieved. I have frequently noticed this curious fact in my own cases.

When the foreign body is lodged in the œsophagus, or in the inferior part of the pharynx, extrusion is often readily effected with a pair of long, slender gullet forceps, such as those represented in figs. 371 and 372, invented by Dr. Bond, of this city, which are most admirably adapted for the purpose. It will be perceived that, besides being very light and curved, they are beveled off at the edges, an arrangement which effectually prevents them from seizing and pinching the mucous membrane, an occurrence which is so liable to happen in the use of the ordinary instrument. Moreover, it admirably fits them for withdrawing needles, pins, and other sharp-pointed bodies, which, while they are firmly held by the blades,

fall into the groove at their sides, and thus slide along the passage without seriously injuring its walls. The patient, sitting upon a low stool, with his head thrown backwards and supported upon the breast of the surgeon, the instrument, well oiled and warmed, is passed down into the tube, and used as a searcher; as soon as it is brought in contact with the extraneous substance, its blades are expanded over it, and extraction effected in as gentle a manner as possible. Pins, needles, and other slender substances, may sometimes be entangled in the loops formed by tying a number of horsehairs to the extremity of a piece of whalebone.

Occasionally a blunt hook is used for effecting extraction. It is carried down in the same manner as the gullet forceps, if possible,

beneath the foreign body, which is then seized and drawn up. Pieces of coin, pins, and bits of bone are sometimes readily removed in this way. A very singular case, in which an operation of this kind proved fatal, occurred many years ago in Cincinnati. A female having, as she supposed, swallowed a pin, a practitioner endeavored to extract it by means of a common dress-hook, secured to the end of a piece of whalebone. In his attempt to withdraw it, the hook became fastened in the œsophagus, the walls of which were severely lacerated. Violent inflammation ensued, followed in a few days by the death of the patient. Professor Cobb, who used to have the preparation in his private cabinet, made the dissection, and discovered the rent, which was upwards of an inch and a quarter in length, just below the larynx. No pin was found, and the probability was that none had ever been swallowed!

An excellent instrument for extracting foreign bodies from the œsophagus is represented in the adjoining sketch (fig. 373). It was constructed for me, at my suggestion, by Mr. Kolbé, and consists of a steel rod, about fifteen inches long, inclosing a stilet, surmounted by four wing-like processes, which may be shut or expanded at pleasure, simply by turning the handle. Another convenient contrivance, constructed with bristles, and acting upon similar principles, is exhibited in fig. 374.

When the substance is of a digestible nature, as a crust of bread, a piece of potato, or a mass of beef, and cannot be readily extracted, it should be pushed down into the stomach by means of a probang, an instrument consisting of a stout whalebone rod, surmounted by a suitable piece of sponge. The operation, which should be performed with great gentleness, the patient sitting on a chair, with the head inclined backwards, is not always so easy as might be imagined. Many years ago, I attended a man, in the inferior part of whose œsophagus a large piece of veal

Fig. 373.

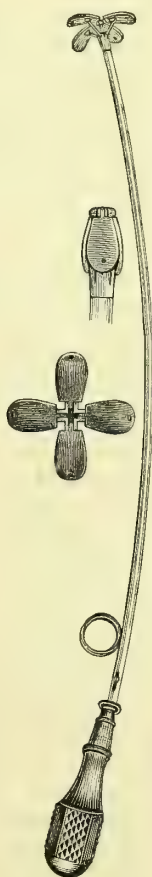
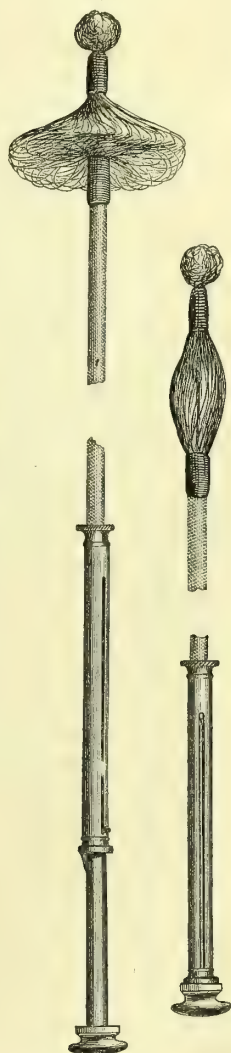


Fig. 374.





had lodged, where it produced excessive irritation and so much spasmodic action as to render it extremely difficult to force it on into the stomach. For several hours his embarrassment of breathing and thoracic distress were most intense.

A fish-hook along with a piece of its line is occasionally swallowed. An instance of this description, and the first of the kind of which I have any knowledge, occurred in 1814, in the practice of Dr. Bright, of New Castle, Kentucky. Having ascertained that the foreign body was quite small, this gentleman supposed that if a ball, pierced at the centre, were passed over the line, and allowed to fall forcibly against the hook, it would be likely to detach it from the coats of the œsophagus, in which there was reason to believe that it had been arrested. The experiment was accordingly tried, and the success was complete. The hook having lost its hold, applied itself against the lower surface of the ball, which thus, in the withdrawal of the line, prevented its barb from injuring the passage.

When a foreign substance, especially if it be rough, sharp, or angular, is retained for any length of time in the gullet, it may occasion serious inflammation, followed by abscess, gangrene, or ulceration, and in this way it may even destroy life. Dorsey has related an instance in which a youth of seventeen suddenly perished from a copious hemorrhage, induced by the long-continued lodgment in the œsophagus of an English farthing. Needles, pins, and bits of bone, after having sojourned for a while in the œsophagus or pharynx, often descend into the stomach, and are ultimately voided by the bowels; or, instead of this, they perforate the coats of these tubes, and travel over different parts of the body, being, perhaps, at length eliminated through the skin; or, finally, they enter the thoracic cavity, and produce destructive inflammation of its contents. In the second volume of the Dublin Hospital Reports, a case is narrated by Mr. Kirby, of a woman who bled to death from injury sustained by the right subclavian artery, from a piece of bone which had perforated the œsophagus, behind which the vessel lay in its anomalous course from the arch of the aorta towards the right side of the trunk.

10. *Œsophagotomy*.—I have never performed œsophagotomy, and such an operation will, I presume, rarely, if ever be required, if a proper direction be given to our attempts at extrusion. It is only when the foreign body is immovably fixed in its position that the question should be at all entertained. Should the operation be decided on, it may be executed in the following manner: The neck being stretched, the head retracted, and the foreign substance made to project as far as possible on the left side of the windpipe, an incision, several inches in length, is made directly over the swelling through the skin and platysma myoid muscle. The tube being thus exposed, and any vessels and nerves that may be in the way held aside, its wall is divided to the requisite extent, and the substance, whatever it may be, is extracted with the finger or forceps, as may be found most convenient. As soon as clearance has been effected, and the bleeding arrested, the edges of the œsophageal wound are neatly approximated by several points of the interrupted suture, made with very fine, but strong silk, the ends

being cut off close to the knots, to afford the ligatures an opportunity of dropping ultimately into the interior of the passage. The cutaneous wound being dressed in the usual manner, the case is managed upon general principles, the patient being supported during the first week with broths, conveyed, if necessary, by means of a tube, or, what will be better, introduced into the rectum.

For a very instructive and learned paper on organic obstruction of the œsophagus, giving the particulars of a case in which Dr. John Watson, of New York, opened both this tube and the trachea for the relief of the patient, who, however, perished several months afterwards, the reader is referred to the *American Journal of the Medical Sciences* for October, 1844.

11. *Passage of Tubes along the Œsophagus.*—The practitioner is sometimes obliged to insert tubes into the stomach for washing out its contents, as in poisoning, or for injecting food into the organ with a view of sustaining life, as in disease of the pharynx and œsophagus. In the former case, the addition of a pump is necessary; in the latter, a gum-elastic bottle. Tubes for either of these purposes should be at least eighteen inches in length, and from four to six lines in diameter. The patient being seated upon a chair, with his head reclining against the breast of an assistant, the instrument, carefully oiled, is cautiously conducted down into the pharynx, and thence along the œsophagus into the stomach. If poison be present, tepid water is now injected, and immediately after withdrawn with the pump; the operation being repeated until there is reason to believe that thorough clearance has been effected. When the tube is inserted for the purpose of injecting nutriment, the fluid should be introduced very slowly, so as not to occasion sudden and painful distension.

It seems to me that none but the veriest bungler could pass such an instrument into the windpipe instead of into the œsophagus, and yet, judging from the cautious manner in which writers lay down their instructions for its introduction, we are forced to conclude that such an occurrence is not only possible, but occasionally even quite probable. The accident would, I suppose, be most likely to happen if the patient were in a state of deep coma or partial asphyxia, thus preventing him from perceiving the contact of the instrument. It has been proposed, under such circumstances, to hold a lighted taper before the tube, on the assumption that, if it be extinguished, it is to be regarded as an evidence that the instrument is in the windpipe, and conversely. But such a procedure is altogether unsatisfactory, and the only safe plan for the surgeon, at last, is to rely upon his knowledge of anatomy, and his manual dexterity. The very facility with which the tube glides along may be taken as positive evidence that it is descending the œsophagus.

## CHAPTER XII.

## HERNIA.

## SECT. I.—GENERAL OBSERVATIONS.

BY the term hernia, as used at the present day, is understood a protrusion of any of the abdominal viscera through a natural or accidental aperture in the abdominal walls, accompanied by a process of the peritoneum, and invested by the common integuments. The parts most liable to this occurrence are the intestines, especially the small, and the omentum. Of the small bowels, the portions most generally concerned in the descent are the ileum and the inferior third of the jejunum. The duodenum is too fixed in its situation to admit of such an accident. The arch and sigmoid flexure of the colon occasionally pass out of the abdomen, and the same fate is sometimes, though rarely, experienced by the cæcum and vermiform appendix. Now and then an instance occurs in which a portion of the stomach, the liver, spleen, or urinary bladder, forms a constituent of the hernia. Cases have also been witnessed where the ovaries, the Fallopian tubes, and even the uterus were protruded. The rectum has occasionally been found included in an ischiatic hernia.

Various *terms* are employed to designate such a tumor, derived either from the nature of its contents, the particular condition of the included structures, or the region of the body in which it occurs. Thus, when the protrusion consists of intestine alone, it is called an *enterocele*; *epiplocele*, when it is composed merely of omentum; and *entero-epiplocele*, when it consists both of intestine and omentum. A hernia is said to be *reducible* when its contents can readily be returned into the peritoneal cavity; *irreducible*, when they remain permanently fixed in their abnormal situation; and *strangulated*, when they are confined by a stricture, or compressed by the edges of the aperture at which they emerged. The term *incarcerated* is used to denote the temporary sojourn of the parts in their extra-mural situation, without any obstruction to the passage of the feces, and the existence of inflammatory symptoms. The words *inguinal*, *scrotal*, *femoral*, *umbilical*, *ischiatic*, *obturator*, and *labial*, have reference to the particular regions in which the descent takes place. Finally, hernia sometimes occurs at birth, and it is then said to be *congenital*.

*Anatomy*.—Every hernia has a distinct sac, besides a certain number of other coverings, a mouth, a neck, and a body. Each of these parts is of sufficient importance to require separate consideration.



The *sac* forms the immediate investment of the protruded parts, and is of a serous nature, being, in fact, merely a prolongation of the parietal portion of the peritoneum, pushed down during their descent. It varies much in its structure, as well as in its size and shape. In the earlier stages of hernia, it generally retains both its natural transparency and tenuity; but in cases of long standing, and particularly in those of large bulk, it is almost always considerably thickened, opaque, dense, and even fibrous; its free surface is rough, corrugated, discolored, and often incrustated with lymph; and the subjacent cellular substance, which is frequently separable into several layers, is commonly indurated, and occasionally loaded with fatty matter. Serum sometimes accumulates in considerable quantity in the sac, constituting a species of genuine dropsy. It need hardly be added that these changes are all the direct product of the inflammatory action which the sac experiences during the progress of the disease. The sac also admits of great extension, as is shown in certain forms of scrotal hernia, in which the tumor descends nearly as low as the knee. Sometimes the sac, instead of being thickened, is remarkably attenuated, or very thin at one point and thickened at another; occasionally, again, cases are witnessed in which it has given way, either by absorption or laceration. It is also to be remembered that there are certain varieties of hernia in which the protruded parts receive only a partial investment of this kind. This is uniformly the case in hernia of the cæcum and bladder, which are but imperfectly covered by peritoneum, in the natural state. A rupture following upon a wound is always destitute of a proper sac.

The *size* of the sac varies from a pigeon's egg to that of an adult's head. In general, it may be assumed that the younger a rupture is the smaller will be the sac, and conversely. It has already been stated that, in scrotal hernia, the tumor occasionally reaches nearly as low down as the knee. Its shape, which is liable to endless diversity, may be globular, pyriform, conical, cylindrical, or hemispherical; occasionally it has a constricted, hour-glass arrangement, or it consists of alternate dilatations and contractions. A double sac is sometimes met with. The annexed drawing (fig. 375), from a preparation in my collection, affords a good illustration of the more common shape of the hernial sac.

The other investments of the tumor vary in number, as well as in their character, in the several regions in which they are situated, and will be described along with the different varieties of hernia. Meanwhile, it may be remarked that every rupture has an integumentary envelop, consisting of skin and cellular

Fig. 375.



tissue, either in their natural state, or variously altered by the pressure of the protruded parts. Muscular fibres seldom form a distinct tunic in any of the varieties of the affection.

The *mouth* of the hernia is that portion of the tumor which forms the communication between the sac above described and the general peritoneal cavity. In its shape it generally resembles an elongated fissure, but in some instances, especially in old and bulky ruptures, it is nearly circular. Its size varies from that of a small aperture to that of an opening capable of admitting a large fist. Two or more sacs have been known to communicate with the abdomen by a common mouth.

The *neck* of the hernia lies just below its mouth, being the narrow, constricted portion, embraced by the edges of the natural or accidental orifice at which the descent has taken place. These boundaries are formed either by muscular, tendinous, or aponeurotic fibres, and, from the character which they play in the production of strangulation, deserve to be studied with the greatest care and attention. The *base* of a hernia is its lower extremity, and the body that portion which lies between the base and the neck.

### 1. REDUCIBLE HERNIA.

The *symptoms* of reducible hernia are greatly influenced by the nature of the protruded structures. An *enterocele* is soft and elastic; smooth, or nearly smooth, on the surface; free from pain and soreness; and of a globular, ovoidal, or conical figure. It imparts a distinct impulse to the finger when the patient coughs; has a gaseous feel; often emits a clear sound on pressure; and disappears during recumbency, but is reproduced immediately on the resumption of the erect posture. The reduction is generally effected suddenly and in mass, with a gurgling, rumbling, or explosive noise. It is worthy of remark, however, that when the bowel contains much solid matter the tumor may be hard, unequal, almost inelastic, and return lazily and almost noiselessly. The size of an enterocele is often considerably influenced by the condition of the alimentary canal; being smaller after fasting and the use of purgatives, and larger when the tube is distended with food, gas, or fecal matter.

In *epiplocele*, the tumor is of a more irregular figure, and of a flabby, doughy consistence, very different from that which characterizes an enterocele; it emits no sound on pressure; imparts no impulse on coughing; is free from tension; does not expand or diminish during the repletion or vacuity of the alimentary tube; and is always reduced with more difficulty than a protruded bowel.

In an *entero-epiplocele* the symptoms are of a mixed nature, and hence the diagnosis is often more obscure than in either of the other forms of the protrusion. If one part of the tumor feel soft, elastic, and gaseous, and the other doughy, heavy, and nearly incompressible; or if one portion slip up quickly and with a gurgling noise, and the other remain stationary, or is less easily replaced, the presumption will be that it contains both intestine and omentum. Frequently,

however, the characteristic symptoms are absent, and the true nature of the swelling can be determined only by the knife.

The *volume* of a hernia, however constituted, is liable to much diversity, and hardly admits of any definite statement. Generally speaking, it may be assumed that the more recent a rupture is the smaller will be its bulk, and conversely; but this law has many exceptions, as is shown, for example, in cases of hernia consequent upon severe muscular exertion and external injury, as a laceration or division of the walls of the abdomen, in which such a protrusion often has a large bulk at the very moment of its occurrence. There are also regional differences in regard to the size of these tumors. Thus a femoral hernia is always, other things being equal, much smaller than an inguinal hernia, its size rarely exceeding that of a pigeon's egg, or an almond. The largest tumors of this kind are, generally, old scrotal and umbilical ruptures.

The *shape* of the tumor is usually intimately connected with that of the proper hernial sac, already described. The most common forms are the globular, ovoidal, cylindrical, and pyriform. In some instances the tumor has a flat, compressed appearance, or the figure of an hour-glass.

Much diversity obtains in regard to the *quantity* of the protruded structures; in general, however, it is in direct proportion to the size of the tumor. In enterocoele the contents of the hernia may consist of nearly the whole of the floating portion of the bowel, of a small loop, or of a part merely of the circumference of the tube; too small, perhaps, to form the slightest appreciable swelling upon the external surface. Large quantities of the omentum also sometimes descend, but in most cases the protrusion is small.

Reducible hernia, unless very large, is rarely attended with any decided derangement of the *general health*. Very commonly, indeed, all the functions of the body are performed in the most perfect and vigorous manner. When the disease becomes troublesome the symptoms usually complained of are such as denote disorder of the digestive apparatus, as indigestion, flatulence, eructations, colic, constipation, and painful, dragging sensations in the abdomen. The patient, in recent cases, is frequently able to move about, and to attend to his business, without any particular suffering or inconvenience, even when he does not wear a truss. I have known persons affected with inguinal hernia live in great comfort for years without any mechanical support whatever.

The *frequency* of hernia cannot be correctly estimated, nor is this a matter of any particular moment in a practical point of view. The probability is that it differs in different countries, in different occupations, and in different classes of society. The affection occurs at all periods of life, from the cradle to the grave. Both sexes are subject to it, but the male in a much greater degree than the female; in the proportion, probably, of nearly ten to one. Men suffer most frequently from inguinal hernia; women, from femoral and umbilical; the differences depending upon either anatomical causes, or physical conformation.



The *causes* of hernia are usually divided into predisposing and exciting. Among the former the principal are, inordinate size of the normal outlets of the abdomen, and the existence of preternatural apertures, from defective development of the walls of this cavity. Under the same head may be included unusual laxity of the muscles and tendons of the abdomen. Distension of the abdomen by pregnancy, ascites, obesity, and different kinds of tumors also favor the formation of hernia. The same is true of tight lacing, mechanical obstruction to the evacuation of the urine, chronic disease of the lower bowel, and general debility, whether natural or acquired.

The most common exciting cause of the disease is inordinate contraction of the diaphragm, pushing the abdominal viscera forcibly against their walls, at the same time that these walls themselves are in a state of excessive tension. The contained and containing structures being thus made to act and react upon each other, the floating parts of the former are often readily thrust across the resisting parts of the latter. Hence hernia is most generally produced in straining at stool, in difficult parturition, lifting heavy weights, playing on wind instruments, jumping, running, vomiting, and coughing. Occasionally the occurrence is the immediate result of external violence, as a blow or wound, separating or severing some of the component structures of the walls of the abdomen.

Wounds of the walls of the abdomen are a frequent cause of hernia. The culpable manner in which these lesions are generally treated can hardly fail to be followed by protrusion of the abdominal viscera. The puncture made in the operation of tapping has occasionally given rise to hernia. Many years ago a remarkable case of this kind occurred in this city, in a lady who was tapped by an eminent practitioner, under the supposition that she had ascites. It turned out, however, that she was merely in an advanced stage of pregnancy. The operation brought on premature delivery, followed soon after by ventral hernia, which, increasing in volume, became at length quite troublesome, the more so, as it was subject to occasional attacks of strangulation, in one of which she lost her life.

## 2. IRREDUCIBLE HERNIA.

An irreducible hernia is one in which the protruded parts do not admit of replacement. Various causes may conspire to produce such a result. Some of these causes are altogether of an adventitious character; others relate to changes experienced by the prolapsed structures, in consequence of their long sojourn on the outside of the peritoneal cavity; and others, again, depend upon the condition of the edges of the opening, whether normal or abnormal, at which the hernia has occurred. Finally, the difficulty may exist on the part of the peritoneal cavity. These causes are of great practical importance, and, therefore, demand separate consideration.

Under the first head of causes, here designated as the adventitious, may be enumerated the adhesions which are so liable to form between the hernial sac and its contents. These adhesions, which are always the

direct result of inflammation, are of variable firmness and extent, according to their duration and the amount of plastic effusion. Sometimes all the protruded structures are united, not only to each other, but to the walls of the sac; but, in general, certain portions are free, while the remainder are more or less adherent. Occasionally distinct bands are seen stretching from one coil of intestine to another, or from a portion of bowel to a portion of omentum, or, finally, from the prolapsed parts to the surface of the hernial sac. In ancient cases the plastic matter often presents itself in the form of cellular tissue, just as it does, under corresponding circumstances, in the pleura and peritoneum.

Secondly, a hernia may be rendered irreducible by the alterations experienced by the protruded structures themselves from interstitial deposits. The omentum is remarkably prone to become hypertrophied from protracted residence on the outside of the abdomen, and similar changes, though not in the same degree, are liable to occur in the bowels. The parts being thus enlarged, perhaps several times beyond their normal volume, are finally rendered incapable of being restored to their original situation. Another cause of the irreducibility of a rupture, but one usually of a more transient character, is the impaction of the bowel with fecal matter, gas, worms, alvine concretions, or some indigestible substance. Sometimes, again, a hernia, originally reducible, may be rendered irreducible by the manner in which the prolapsed parts, especially if consisting of intestine and omentum, are twisted round each other.

Thirdly, the cause of the difficulty may exist in the opening in the wall of the abdomen, the margins of which may either contract, and thus prevent the return of the protruded parts; or the orifice may retain its original dimensions, and yet, in consequence of the changes experienced by the contents of the tumor, the hernia may be rendered irreducible. The whole difficulty, in either case, evidently depends upon a loss in the relative size of the parts concerned in the disease.

Finally, the irreducibility of the hernia may depend upon the contraction of the peritoneal cavity, or an unwillingness, so to speak, on the part of this cavity, to reclaim its original possessions. Such an occurrence is very likely to happen in very large and old ruptures, embracing an unusual quantity of bowel and omentum, or of bowel and some solid viscus, as the liver, spleen, or uterus. The parts having resided for a long time in their new situation are found, when an attempt is made to restore them to their former position, to be too bulky for the now contracted size of the abdominal cavity.

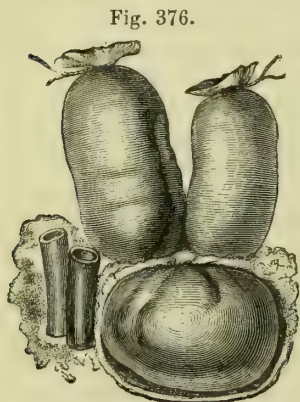
The above causes, excepting the first, are generally tardy in their operation, and hence a considerable period often elapses before the protruded structures become finally irreducible. When inflammation is set up in the sac, or in the prolapsed parts, whether accidentally or otherwise, a hernia may be rendered irreducible in a very few days. The varieties of rupture most liable to this occurrence are the scrotal and umbilical.

Persons affected with irreducible hernia are subject to habitual derangement of the digestive apparatus, especially to flatulence, eructations, acidity, nausea, colicky pains and constipation of the bowels.

The size of the tumor varies; it often remains stationary, or nearly so, for years; but in the end it is sure to increase, and frequently attains an enormous bulk.

### 3. STRANGULATED HERNIA.

Strangulated hernia is that form of the disease in which the protruded parts are firmly, painfully, and injuriously compressed by the edges of the opening at which the descent has taken place, or at the neck of the sac, as seen in fig. 376. Sometimes, however, the constriction occurs at the mouth of the sac, in the interior of the sac, or between the prolapsed structures themselves. Thus, a protruded bowel has occasionally been strangulated by being tightly embraced by a piece of omentum, and conversely.



Strangulated hernia.

Small and recent ruptures are, other things being equal, most liable to strangulation. In such cases, too, the danger, both to the part and system, is always much greater when the strangulation is not promptly relieved, than in herniæ of large size and of long standing, for the reason that the constriction is usually more severe in the

former than in the latter, and, therefore, more liable to be followed by mortification. The varieties of hernia in which the strangulation is commonly most violent and dangerous, are the femoral and concealed inguinal; both of them usually of small size, and for this reason, unfortunately, apt to be overlooked.

Strangulation generally takes place suddenly, in consequence of some violent muscular exertion, as in leaping, running, lifting, or coughing. However induced, the person is soon rendered conscious of the occurrence by the tender state of the tumor, and by a sense of general uneasiness in the abdomen. Gradually, perhaps rapidly, the suffering increases; the parts become exquisitely painful, both at the site of the swelling and for some distance around; the slightest touch even of the finger is frequently intolerable; a feeling of constriction, as if a cord were stretched tightly round the belly, is often complained of; the patient lies upon his back, with the knees retracted and the shoulders elevated, in order to relieve the parts as much as possible of their tension; there is more or less restlessness, and even jactitation; the pulse is frequent, hard, and wiry; the mouth is dry, the thirst is urgent, the surface is hot, the countenance is flushed, and the head is oppressed with pain. By and by nausea and vomiting occur, at first of ingesta, then, perhaps, of bile and mucus, and finally of stercoraceous matter; hiccup now sets in, and twitching of the tendons soon becomes a prominent symptom. The mind wanders, sometimes even at an early stage, and not unfrequently there is low, muttering delirium. The bowels are usually obstinately constipated from the first, or if there be any



alvine discharge, it is derived entirely from the part of the bowel below the seat of the mischief. If, when the case has reached this crisis, prompt relief be not afforded, another series of changes occurs, still more striking and portentous. The countenance now assumes that peculiar shrunken aspect, so well described by Hippocrates, and hence usually called by his name; the tongue is dry, tremulous, and unable to protrude itself; the gums and teeth are incrustated with sordes; the surface is covered with clammy perspiration; the extremities are icy cold; the tumor crackles under pressure, and is of a livid color; and the patient is in a state of the utmost exhaustion, unable to answer any questions, or to maintain himself upon his pillow. The pain, previously complained of, has suddenly ceased, and the poor sufferer, if not wholly unconscious of his condition, perhaps flatters himself that he will soon be well, when, in fact, he is in the very jaws of death. Mortification of the protruded parts has taken place, and his only hope of safety is in the formation of an artificial anus. The period at which death occurs varies, on an average, from three to five days, being generally earlier in strangulation of small and recent herniæ than in that consequent upon large and old.

The symptoms of strangulation, especially in its earlier stages, are not always as urgent as they have been here represented. Sometimes, indeed, they are exceedingly mild, even for several days, when, perhaps, all of a sudden, they become greatly aggravated, and denotive of the worst consequences. It is worthy of remark that they are usually more severe in strangulation of the bowel than in strangulation of the omentum.

*Dissection* of the body after death from hernia reveals, in general, nothing but the ordinary evidences of peritonitis. The protruded parts are in a state of the most profound vascular engorgement, livid, purple, or claret in color, and incrustated with plastic matter. If gangrenous spots exist, they are easily recognized by their greenish or blackish hue, and by their soft consistence. At the seat of the stricture the bowel is usually ulcerated, or pierced with apertures, so small, commonly, as hardly to admit even of the escape of gas, much less of mucus and feces. Occasionally the only morbid change there is a ring-like groove in the walls of the intestine. The sac, participating in the morbid action, generally exhibits strong traces of inflammation. On laying it open there is almost always an escape of serous fluid, varying much in quantity and color in different cases, and under different circumstances. While it is seldom entirely absent, in any instance, it rarely exceeds half an ounce or six drachms, the average ranging from a drachm and a half to two drachms. Its color is at first like that of water, but as the strangulation advances it is rendered red, dark, or purple, from the admixture of hematin. Occasionally the sac contains pure blood, but this is unusual. The external investments of the tumor are more or less congested, discolored, and, when the mortification has extended also to them, emphysematous, from the extrication of gas.

The general peritoneal surface also exhibits traces of the effects of the strangulation, being always most distinct at and immediately around

the seat of the constriction. The affected parts are variously discolored, incrustated with lymph, and here and there adherent. Occasionally the cavity of the serous membrane contains a small quantity of altered serosity. Such, in few words, are the usual and most prominent morbid changes observed after death from strangulated hernia.

If the patient survive the effects of the mortification, the superincumbent structures of the hernia slough away, and the dislocated bowel being also opened, an artificial anus is established, admitting thus of the discharge of fecal matter along the upper portion of the tube; while that which intervenes between the accidental and natural outlets, gradually unburdening itself of its contents, sinks into a state of collapse.

#### TREATMENT.

The treatment of hernia must necessarily vary according to the nature of the complaint, as to whether it is reducible, irreducible, or strangulated, and numerous other circumstances which it will be my object to enforce during the progress of my remarks.

*a. Reducible Hernia.*—For the reducible hernia the best remedy is a suitable truss, an instrument designed to answer the purpose of a retentive apparatus. It should be applied as soon as the true nature of the disease has been determined, and be worn uninterruptedly until there is reason to believe that the opening through which the descent has taken place has become effectually and permanently closed. Even when this object cannot be expected to be attained, on account of the great size of the aperture, the long standing of the case, and the advanced age of the patient, the parts should be constantly maintained in their natural position, lest, in an unguarded moment, or in consequence of sudden and violent muscular exertion, recurrence of the rupture should take place, and the displaced parts become strangulated. There is no period of life, except that of early infancy, in which a truss, if properly constructed and adjusted, may not be worn with advantage, if not with a prospect of ultimate cure. The only objection to the use of such an instrument in very young children is its liability to chafe the skin, and to become soiled by the excretions, thus imposing a great deal of care and anxiety upon its attendants.

The *trusses* of the present day are, in every respect, very superior to those in use even a quarter of a century ago. The instruments invented by Stagner and Hood, of Kentucky, and afterwards improved by Chase, Dodson, and others, are nearly as perfect as it is possible to make such contrivances. They combine great cheapness and finish with extraordinary lightness and efficiency, and are every way worthy of the favor which they have received in this country and in Europe. The substitution of the wooden block for the soft pads, formerly in vogue, was one of the most valuable additions to the mechanical surgery of the present century. With the old instrument it was not only frequently difficult to maintain the reduction of the hernia, but such a thing as a radical cure was hardly ever even thought of. The American truss, on the contrary, while it most effectually answers the

purpose of a retentive apparatus, often, by the steady, gentle, and uniform pressure of its block, permanently cures the disease.

The truss of Stagner and Hood, improved by Chase and others, is represented in the annexed engraving (fig. 377). The block, composed of beech or cedar, is of a semi-ovoidal shape, convex on its abdominal surface, and flat externally; it is placed more or less obliquely, and is, in regard to the spring, so arranged as to admit of being moved, in order to adapt it more accurately to the part and body. Its great advantages are its uniform consistence and smoothness, its durability, and its inability to imbibe perspiration; qualities which are nearly all wanting in the pads of the older instruments, as well as in many of the modern.

Fig. 377.

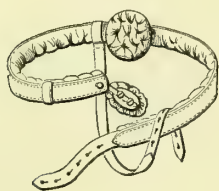
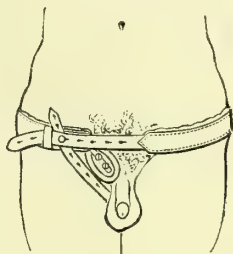


Fig. 378.



The spring consists of a light, but strong band of steel, capable of encircling about two-thirds of the body, very flexible and elastic, and thoroughly covered to prevent it from chafing the skin. The leather which surrounds the spring terminates in a free extremity, provided with numerous apertures for fastening it at the other end of the instrument, to a screw just beyond the block. To prevent the truss from slipping up, over the hips, a thigh-strap, also well padded, is attached to it. The adjoining cut (fig. 378), represents the instrument as applied to the body.

It is hardly possible for a person to obtain a well-fitting truss without direct consultation with the manufacturer. This is a matter which is, unfortunately, too much neglected, the patient too often thinking that he can effect by proxy what he ought always to do himself. When the proper examination cannot be made by the cutler, the measure of the body around the hips should be carefully taken with a piece of annealed wire, which should then be sent, with an account of the particular form of the rupture, an inch to an inch and a half being allowed for the padding. Every person having hernia should have two instruments of this kind, so that, in the event of accident, he may not be obliged to be without a truss while the broken one is undergoing repair. For want of this precaution patients have occasionally incurred great risk to life.

The chances of a radical cure by the use of the truss are, other things being equal, always greater in proportion to the small size and recent standing of the hernia, the absence of obesity, and the youth of the patient. When the tumor is large, the probability of effecting the obliteration of the abdominal aperture will be comparatively slight,



on account of the difficulty of procuring an adequate supply of plastic matter, and hence few such cases ever thoroughly recover. Under opposite circumstances, on the contrary, the opening is often closed in a short time, for then the parts are more easily influenced by adhesive inflammation, which the steady and persistent pressure of the instrument has a tendency to excite. The sooner, therefore, a truss is applied, the better it fits, and the more steadily it is worn, the greater will be the chances of a speedy and permanent cure. Yet the fact that a rupture is old and bulky should not prevent the use of such an expedient, provided the parts are still reducible; for the efforts of the surgeon are occasionally crowned with success in cases apparently the most unpromising. Should no radical cure follow, the patient will lose nothing by the attempt; but, instead of this, he will be a decided gainer, inasmuch as the tumor will not only not increase under such management, but will be effectually guarded against strangulation. Some difference in respect to the curability of hernia occurs as this complaint manifests itself in different regions of the abdomen. Thus, an inguinal hernia is always more easily relieved than a femoral, umbilical, or scrotal, for the reason, doubtless, that the structures through which the descent takes place are more easily compressed, and, therefore, more easily influenced by exudative inflammation. In young subjects the probability is that the obliteration of the abdominal aperture is materially promoted by the natural tendency which its margins have to contract. In no instance, perhaps, is there much effusion of plastic lymph; certainly much less than is generally supposed. The importance, therefore, of giving early and efficient support, not only to the parts immediately interested in the protrusion, but to the whole abdomen, must at once be obvious, and should receive due attention in every case where the object is to bring about such a result. The efficiency of the truss, in promoting the radical cure of hernia, may be greatly increased, in almost every case, by the use of an abdominal supporter, constructed upon the principle of the instrument employed by women in displacement of the uterus. The weight of the abdominal viscera being thus measurably taken off from the inguinal rings, retention of the bowel is not only much more easily effected, but the edges of the rings are not so likely to be separated, and the adhesions, consequent upon the wearing of the truss, broken up. Although my experience with this treatment is limited, I am satisfied that its advantages are very great.

Various methods, besides the truss, have been suggested for promoting the radical cure of hernia; of these, some date back to a remote period of the profession, and partake largely of the rude nature which characterized the practice of our forefathers. To this category belong the operations of excision of the sac, the exposure of the sac and the application of the ligature to its neck, and the incision of the sac and the use of irritants for the purpose of inducing its obliteration, and all of which resulted not only in much suffering, but in the loss of many lives. What surprises one is, not that these operations should have been practised in ancient times, but that they should have been repeated at a comparatively recent period. In scrotal hernia, the

testicles were often extirpated along with the hernial sac; and so common had this practice become in the seventeenth century that, as Dionis informs us, an itinerant operator was in the habit of feeding his dogs with the organs which he thus removed. Hardly less cruel and unscientific are some of the modern devices for the radical cure of this complaint, especially that of Belmas, which consists in exposing the neck of the sac, and introducing little bladders of gold beater's skin with a view of exciting adhesive inflammation.

Within the last thirty years, chiefly through the influence of Mons. Gerdy, invagination of the common integuments has occasionally been practised for the radical cure of hernia, although with no encouraging success. It is principally adapted to the inguinal form of the complaint, and simply consists, as originally executed, in pushing up a fold of skin as far as possible into the neck of the sac, which is then confined there by two points of interrupted suture, introduced by means of a stout, curved needle, through the superimposed structures—muscles, fasciæ, and skin—and separated about one-third of an inch from each other, the ends being tied over a piece of bougie. The pouch of inverted skin is then denuded of its cuticle with spirits of ammonia, which, causing inflammation in the contiguous surfaces, is thus instrumental in gluing them firmly to each other and to the peritoneum.

The operation of Gerdy has fallen into merited neglect, for, independently of the fact that it frequently completely failed, it was not always devoid of danger. Of sixty-two cases of it, collected by Thierry, four are known to have perished, while it is altogether probable that only a few were radically cured. The principles of the operation, however, have been preserved, and have, in a modified form, done good service in the hands of other surgeons.

Another plan, at first sight very specious, but also found, upon trial, to be nearly useless, consists in scarifying the neck of the sac, by means of a delicate bistoury, introduced subcutaneously. Pressure is afterwards made with a truss, to approximate the opposed surfaces, in order to facilitate their union by plastic matter. This operation originated with Mons. Guerin, the tenotomist.

A third plan for the radical cure of hernia was suggested, in 1836, by Mons. Bonnet, of Lyons. It is called acupuncture, as it is performed by transfixing the sac with a number of pins, which are permitted to remain until there is ulceration of the skin, compression being exercised in the intervals of the little instruments, for the purpose of promoting adhesive action. Of eleven cases thus treated by Bonnet, four were cured, five were unsuccessful, and two proved fatal; a result sufficient to condemn the procedure.

I may here mention the method of treatment proposed by Professor Pancoast, and practised by him successfully in thirteen cases. It is essentially similar to the operation for the radical cure of hydrocele by injection, consisting in the introduction of some mildly irritating fluid, of which the tincture of iodine is, perhaps, the best. The protruded viscera having been carefully replaced, and firm pressure being made upon the hernial aperture, a drachm of iodine is thrown

into the sac, and pressed over its inner surface, so as to bring it in contact with every portion of it. The operation is performed with a delicate trocar, with the point of which the sac is freely scarified before the fluid is forced through the canula. The injection being over, a stout compress is applied over the hernial opening, and unremittingly supported by the pressure of a well-adjusted truss. The iodine is soon absorbed, and a cure results either by a change in the secernent vessels, or by the agglutination of the contiguous surfaces. The operation, which occasionally requires to be repeated a second, and even a third time, must be performed with the greatest care, lest some of the fluid should pass into the abdominal cavity, and cause fatal peritonitis.

The late Dr. Jameson, of Baltimore, many years ago, performed an operation for the radical cure of a femoral hernia, in the case of a young lady, by dissecting up a tongue-like flap of integument, from the neighborhood of Poupart's ligament, and inserting its base, which was fully three-quarters of an inch in width, into the femoral canal. The edges of the wound were then drawn together over the flap, by several sutures. For a few days the patient was restless and annoyed by vomiting; and, although the parts did not all unite by the first intention, yet they soon got well, the transplanted integument contracting into a hard knot over the femoral ring, which was thus completely closed, the recovery being perfect. I am not aware that this operation has ever been repeated.

A very eligible method of treatment for the radical cure of hernia, one which has been more frequently employed successfully than any other, was proposed by Professor Wutzer, of Bonn, in 1838. It consists in obliterating the sac of the hernia by invaginating a portion of integument, as originally suggested by Gerdy, by means of an instrument of peculiar construction, consisting essentially of three pieces, a wooden cylinder, a curved needle, and a concave wooden cover, which are retained until the contiguous structures have contracted firm adhesions to each other.

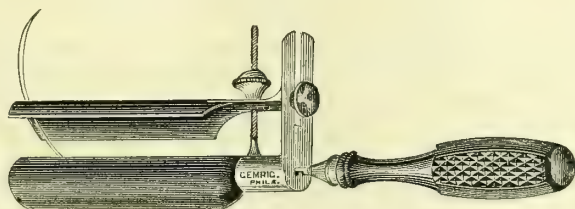
The wooden cylinder is three inches in length, and from three-eighths to three-quarters of an inch in diameter, according to the size of the hernial canal. It is of a somewhat flattened shape, perfectly smooth, and rounded off at the free extremity, a short distance from which, upon its inner surface, is a small opening for the passage of a long, curved needle, which is concealed in its interior, and attached to a movable handle. The cover, also made of wood, is concave on its inner surface, and of the same length and width as the cylinder, to which it is secured by a screw. It also has an opening for the passage of the needle. The accompanying cut (fig. 379) conveys a good idea of this apparently complicated, but really very simple and efficient instrument.

The protruded parts having been returned, a fold of integument is pushed up as far as possible into the canal of the hernia with the index finger of the left hand, its palmar surface being directed forwards and upwards. The cylinder, well oiled, is then carried along the cul-de-sac thus formed, guided by the finger, which is gradually withdrawn as the instrument enters. Assuring himself that the extremity of the



cylinder is fairly lodged in the internal ring, as he readily may by observing that it is firmly fixed in its place, the surgeon pushes the needle through the sac of the hernia, the canal, and the integument,

Fig. 379.



and screwing the cover moderately tightly on the skin, he removes the handle of the needle, leaving the remainder of the apparatus upon the abdomen. The protruding portion of the needle is protected with a piece of cork. The principal precaution necessary, in performing this operation, is to see that the cylinder is thoroughly secured in the inguinal canal. In hernia of long standing, attended with unusual laxity of the cellular tissue, it is liable to be pushed up beneath the skin of the abdomen; a circumstance, however, which is always easily detected by the fact that the instrument is more movable than when it is in its proper place.

The apparatus is retained for a period varying, on an average, from six to eight days, the cover being tightened or relaxed, from time to time, according to the tolerance of the parts, and the amount of the resulting inflammation. The puncture made by the needle generally begins to suppurate about the end of the fourth day. The patient is kept perfectly at rest in the recumbent posture, pain is allayed by anodynes, the bowels are not permitted to move, and the diet is perfectly plain and simple. If peritonitis should arise, which, however, is seldom the case, the symptoms must be met by the ordinary remedies, and all compression be immediately removed. When the apparatus is taken off, the patient must not get up at once, but remain on his back a while longer; and when, at length, he begins to exercise, he must be careful to support the parts with a well-adjusted truss, the use of which should be continued for at least six months after, lest, the adhesions giving way, the disease should be reproduced.

Professor Armsby, of Albany, New York, has modified the operation of Wutzer by substituting for the needle a single thread, which is introduced, as a seton, through the hernial sac and inguinal canal, by an appropriate instrument, invagination of the integument having been previously effected, as in the other process. The thread being brought out by one end at the upper part of the internal ring, and by the other at the lower part of the scrotum, is occasionally moved, in order to provoke the requisite amount of inflammation. A truss is applied for a few hours immediately after the operation.

Dr. J. W. Riggs, of New York, has likewise suggested the use of the seton for the radical cure of this disease, but on a larger scale than that recommended by Dr. Armsby. In the New York Journal of

Medicine and Surgery for March, 1858, he has described and delineated an ingenious instrument for performing the operation, and has given the results of eight cases, two from his own practice, and six from that of Professor Carnochan, nearly all being successful, without any bad symptoms having followed. Several of the cases were of very long standing.

Finally, I may here briefly allude to another ingenious modification of Wutzer's operation, the process of Dr. Hachenberg, of Dayton, Ohio, consisting of the introduction into the cutaneous cul de-sac of a perforated ivory ball, attached to a long, double thread, the upper end of which is brought out at the superior part of the internal ring, where it is secured to an apparatus designed for the purpose, while the other end is left pendent below. Inflammation soon follows, and when suppuration is established, the fastening to the abdomen is loosened, and the ball withdrawn by traction upon the lower portion of the ligature. Of three cases treated by Dr. Hachenberg by this method, two are said to have been entirely successful, and the other materially benefited.

The cases best fitted for these various procedures are such as are of comparatively recent standing, and unaccompanied by any great bulk of the tumor. When the canal is much diminished in length, and increased in diameter, as generally occurs in old ruptures, in which the orifices of the canal are on the same line, and immediately above each other, a cure will generally be impracticable by any method whatever. To femoral, umbilical, and ventral herniæ, these procedures are not adapted, owing to the greater risk of peritonitis and extensive suppuration.

In a case of hernia, consequent upon a wound of the abdomen, in a young man, about thirty years of age, I succeeded in effecting a very excellent cure by cutting down upon the parts, and closing the opening with four interrupted sutures, carried through its muscular edges, which had been previously well pared, upon the same principle as in hare-lip. The operation, which was performed last December at the College Clinic, was unattended by a solitary unpleasant symptom. In the New Orleans Journal for March, 1859, my friend and former pupil, Professor Richardson, has suggested the propriety of treating inguinal hernia by means of the silver wire suture, introduced subcutaneously. The idea is certainly ingenious, and will no doubt receive due attention. It is easy, however, to suppose that the operation must often fail for the want of a sufficiently abundant plasma. Hence, direct incision would be preferable.

*b. Irreducible Hernia.*—In the treatment of irreducible hernia three prominent indications are presented: first, to render the affection reducible; secondly, where this cannot be done, to prevent its increase; and, thirdly, to palliate the suffering caused by the confined and compressed condition of the displaced parts.

The probability of a successful fulfilment of the first indication will depend materially upon the circumstances of each individual case, and cannot, therefore, be stated with any degree of precision. The most important of these circumstances are the size and age of the hernia,

and the condition of the general health. A small tumor will, other things being equal, be more likely to become reducible than a large one, and one of recent standing than one that is old. Indeed, it is questionable, when the tumor is very bulky, whether its contents ought to be returned, supposing that they could be disengaged, on account of the injurious impression which they would create in the abdominal cavity, which, in consequence of their long absence and great size, would be little disposed to accommodate itself to their presence, or provide for them a new home. The chances of a fortunate issue will also be greater in a sound than in a sickly person, the function of absorption, upon the vigorous execution of which the favorable result essentially depends, being always performed more energetically in the former than in the latter. The measures best calculated for fulfilling this indication, whether the cause of the non-reducibility be hypertrophy or adhesion, are, absolute rest in the recumbent posture, low diet, venesection, purgatives, mercurials, and sorbefacient applications.

Without repose in the recumbent posture, absolute, steady, and protracted, no course of treatment, however judiciously conducted in other respects, will be likely to prove of the slightest avail. The diet should be non-stimulant, farinaceous, and barely sufficient to support life; it should be low, in the broadest sense of the term. If the patient is young and robust, the treatment may be commenced with the abstraction of from sixteen to twenty ounces of blood, the operation being afterwards repeated to one-half, one-third, or one-fourth of that extent every eight, twelve, or fifteen days, until the patient is so far drained of fluids as absolutely to forbid any further depletion. In old and enfeebled subjects, the lancet must either be withheld entirely, or used with much caution. Purgatives will be of the greatest benefit throughout the whole course of the treatment, whether short or protracted, or whatever may be the condition of the patient in other respects. They not only unload the bowels, and thus prevent fecal accumulation in the protruded viscus, but they aid in equalizing the circulation, and in promoting absorption. The best articles are compound extract of colocynth, jalap, and blue mass, given in doses sufficiently large to produce one or two efficient motions, and repeated every third, fourth, or fifth night. Their action may be assisted, if necessary, by enemata or saline laxatives.

As soon as the system has been properly prepared by diet, venesection, and purgatives, the patient should be subjected to the use of mercurials, such as calomel, blue mass, or corrosive sublimate, with a view to the gradual production of ptyalism, which should be steadily, but cautiously continued for many weeks. Such a course is always equally indicated, whether the cause of the irreducibleness of the hernia be hypertrophy or adhesion of the protruded viscera. The manner in which it proves beneficial need not be pointed out here, as it has been explained elsewhere. Along with the mercurials might be used, more or less freely, the iodide of potassium, and hydrochlorate of ammonia, alternately every other week, in doses varying from ten to thirty grains thrice a day.



As it respects the local treatment, the first thing to be done is to suspend the tumor by means of an appropriate apparatus, so that it shall receive no injurious impulse from coughing, straining, or other muscular exertion. This point being attended to, sorbefacient lotions are diligently plied, as solutions of acetate of lead, Goulard's extract, or, what is better, of hydrochlorate of ammonia. Various stimulating liniments and unguents may also be used, especially after the case has been some time under treatment. Occasionally steady, systematic compression answers a good purpose; maintained either with adhesive strips, as in the treatment of subacute orchitis, or by means of a truss with a hollow pad, progressively lined with layers of leather, or furnished with a gum-elastic air cushion.

It is impossible to say how long, in any given case, this mode of treatment should be continued, before its good effects will become apparent, or before we can determine the probability of its inutility. In the few cases in which I have employed it, I have found it extremely difficult to secure the hearty co-operation of the patient beyond six or eight weeks, and I am satisfied that few persons will be found willing to submit to it even that long. This plan of treatment is similar, it will be perceived, to that of Valsalva for the radical cure of aneurism, and was doubtless originally suggested by the circumstance that, during protracted illness, an irreducible hernia has occasionally disappeared spontaneously, the protruded viscera having become disengaged from their sac, or drawn the sac along with them into the abdominal cavity.

When the case is hopelessly irreducible, all that can be done is to support the parts in such a manner as to prevent their further descent, and, at the same time, protect them from injury. When the tumor is small the best contrivance is an ordinary spring truss with a hollow pad, made either of metal, gutta-percha, or unoled sole-leather, its interior being well padded with buckskin, or some other soft, pliant material, to protect the surface from undue pressure. Such an apparatus will answer nearly equally well for all varieties of irreducible hernia, whether inguinal, femoral, umbilical, or ventral. When, on the contrary, the tumor is very bulky, the gum-elastic suspensory takes the place of the hollow-truss, as better adapted to sustain the heavy and pendulous mass. As now manufactured in our larger cities, especially in Philadelphia and New York, it is difficult to imagine anything of the kind more perfect, comfortable, and convenient. It is incomparably superior to the numerous and clumsy contrivances so much in vogue a few years ago. The suspensory, while it may be readily adapted to all the varieties of irreducible rupture, is particularly applicable to the scrotal, the descent of which it is well calculated to restrain by the steady and uniform compression which it exercises upon the pendulous tumor.

The colicky pains, dragging sensations, and dyspeptic symptoms, so common in persons laboring under irreducible hernia, are best relieved by attention to the diet and bowels, and the avoidance of severe muscular exertion. The food should be plain, simple, and concentrated, comprising the greatest possible amount of nutriment in the

smallest possible space; acidity and flatulence should be remedied by the alkalies, especially the bicarbonates, carminatives, and tonics; and the bowels should be maintained in a soluble state by some mild vegetable pill, or the saline cathartics. In short, the patient, while he should consider himself constantly as an invalid, should do everything in his power to keep his health as near as possible to the normal standard; neither starving himself, on the one hand, nor indulging in any excesses, on the other.

*c. Strangulated Hernia.*—For the relief of strangulation various means are at our command, all resolving themselves into the one great and important element of an early and effectual reduction; for it must be evident that there can be no safety either for the parts or the patient so long as the protruded viscera are permitted to remain in their constricted condition. The sooner, therefore, an attempt is made to restore them to their natural situation, the greater will be the chance of preventing inflammation, which is so much to be dreaded in all cases of this kind, because it constitutes the chief source of danger. The period at which inflammation supervenes after the occurrence of the strangulation varies from a few hours to several days, depending mainly upon the nature of the protrusion, the character of the stricture, and the state of the system. As a general rule, it may be assumed that the occurrence will be early in direct ratio to the small size and recent standing of the hernia, the firmness of the parts opposing restoration, and the robustness of the patient. Once begun, the inflammation may proceed with great rapidity, involving not only the whole of the protruded viscera, but extending, as we have already seen, on the one hand, to the general peritoneal cavity, and, on the other, to the various coverings of the tumor. This being the case, no one can doubt the propriety of early restorative interference.

The means which are employed for effecting the reduction of the strangulated parts constitute what is called the *taxis*, a Greek term, signifying to set in order, or to restore what has been deranged. It has reference merely to certain manual efforts at replacement, which should always be tried before we resort to the knife. The only exception to this rule is where the strangulation has existed so long, and the symptoms, local and constitutional, are so urgent, as to render it probable that, if practised, the protruded structures would suffer serious detriment. In such a case the best *taxis* is the knife.

In order to impart all possible efficiency to the *taxis*, it is necessary, first, to evacuate the bladder, and also the rectum, provided it be much distended; secondly, to relax the abdominal muscles; and thirdly, to use certain adjuvants, as chloroform, venesection, and external applications. The first of these objects is attained by the patient's own efforts, or, if necessary, by the catheter, and by a slightly stimulating enema; and the second, by placing the patient upon his back, and elevating the head and shoulders, the thighs being bent nearly at a right angle with the trunk, and held close together by an assistant, with the toes somewhat inverted. In most cases, if, indeed, not in all, great advantage will be derived from putting a pillow under the buttocks, so as to lift up the pelvis. In this manner, the points of attach-

ment of the abdominal muscles being made to approximate each other, the greatest possible degree of relaxation will be secured; a circumstance of paramount importance in all such proceedings. The third indication is fulfilled by the administration of chloroform, carried to the extent of complete obliviousness. The part and system being thus thoroughly relaxed, the surgeon, standing, sitting, or kneeling, as may be most convenient, close to the right side of the patient, as he lies upon the edge of the bed, the sofa, or the floor, grasps the tumor with the right hand, and draws it carefully downwards towards himself, to disengage the protruded parts from the neck of the sac, and at the same time give them the proper direction in relation to the outlet of the opening or canal through which they have descended. This being done, he exerts gentle, uniform, and steady pressure upon it, to force out its contents, the left thumb and index finger being applied to the upper part of the tumor for the purpose of fixing it at that point, and thus promoting the reduction. If the hernia is very large, the manipulation is performed with both hands, with a degree of caution the greater as the force will now be likely to be more considerable. In a few minutes—perhaps only a few seconds—after the pressure has been applied the operator will generally be conscious of a slight noise, as well as of a slight diminution of the tumor, caused by an escape of gas, and, perhaps, also of fecal matter. Steadily continuing his efforts, he finds that one portion after another of the protruded parts goes up, the last usually with a distinct gurgling sound, until the sac is completely emptied of its contents. Sometimes the most trifling pressure is sufficient for the replacement, while at other times a large amount is necessary. When the hernia consists both of bowel and omentum, the former generally ascends before the latter, though in this respect there is not a little diversity in different cases.

The length of time during which the taxis should be continued must vary according to circumstances; in general, an old hernia will, when strangulated, bear pressure much better, and also for a longer time, than a recent one, and a large than a small one. Much will likewise depend upon the amount of inflammation that may be present in the protruded viscera, the parts being always most tolerant of manipulation when this is slight, or when it exists only in a moderate degree. Then, again, a good deal will depend upon the peculiarity of each individual, one person enduring pain much better than another, although the bowel and omentum may be equally severely compressed in both. When the symptoms are urgent, it is a good rule not to continue the efforts at the taxis beyond ten, twelve, or, at most, fifteen minutes, but to proceed at once to an operation, or, what is preferable, to administer a full anodyne, and cover the tumor with some refrigerant lotion. At the end of some hours, the manipulations may be renewed, and now, perhaps, with a better prospect of success, seeing that the parts have had time to become soothed and relaxed. These attempts also failing, the operation is at once proceeded with.

The taxis may be aided, in addition to chloroform, by venesection, the warm bath, anodynes, and various external applications.

*Venesection*, carried to the extent of partial syncope, has generally



been viewed as one of the most valuable auxiliaries of the taxis. The blood should be drawn in a full stream, while the patient is in the erect or semi-erect posture, the object of the operation not being spoliative, but exhaustive. Thus performed, it seldom fails to relax the abdominal muscles, to reduce the tumor, and to prevent or relieve inflammation. Bleeding, however, is not to be resorted to indiscriminately; for, while it is exceedingly important in small and recent hernias, occurring in young, robust subjects, with a strong, hard, and frequent pulse, and great tenderness of the abdomen, it is altogether inadmissible in protracted strangulation, or in aged and debilitated persons. A small, rapid, and wiry pulse, so characteristic of peritonitis, does not contraindicate venesection, unless there is other evidence of prostration, as coldness of the extremities, profuse perspiration, and collapse of the features. In my own practice, a resort to bleeding, as an auxiliary of the taxis, has been exceedingly uncommon, chloroform having afforded me all the aid I could desire. When the parts are much inflamed, blood may sometimes be advantageously taken from the tumor by leeches.

The *warm bath* is used nearly with the same view as venesection, namely, to depress the system, and induce relaxation of the abdominal muscles. The temperature, at the moment of the immersion, should be about  $90^{\circ}$  of Fahrenheit, from which it should be gradually raised to  $110^{\circ}$ . As soon as a disposition to faintness is felt, the taxis is renewed, and is often successful, especially if aided by anæsthesia. Owing to the inconveniences attending its use, the warm bath is rarely employed in private practice, and perhaps this is well, for there is certainly not much sense in parboiling a man when he can be so easily relieved with the aid of chloroform.

Among the adjuvants of the taxis, *anodynes* hold deservedly a high rank. They sometimes succeed when everything else fails. They relieve vomiting, diminish the morbid sensibility of the tumor, tranquillize the system, and induce sleep, during which the reduction of the hernia is occasionally effected as if by magic. They should be given in full doses, either in the form of morphia, opium, or laudanum, according to the judgment of the practitioner. When they cannot be taken by the mouth, they should be administered by the rectum, which, indeed, is sometimes the preferable mode. In this way, I have repeatedly succeeded in effecting the reduction of a strangulated hernia, with the greatest facility. A good rule is, when the symptoms are not urgent, and especially when the patient is averse to the use of chloroform, to give four grains of opium, and, if the parts do not return of their own accord during the resulting sleep, to employ the taxis within from four to six hours afterwards, or before the effects of the medicine have begun to pass off. It has happened, more than once, that a strangulated hernia, upon which the taxis had been tried in vain, has spontaneously disappeared during a natural sleep, much to the discomfort of the ever-ready knife's man.

No educated surgeon at the present day would think of employing *tobacco* and tartar-emetic, as auxiliaries of the taxis. Fortunately this practice, which numbers many victims, has either become obsolete, or

is rapidly tending that way. Prior to the discovery of chloroform, as an anæsthetic agent, there was some excuse for the use of these potent remedies; but certainly none exists at the present day.

The employment of *purgatives*, too, cannot be too pointedly condemned, inasmuch as they are liable to cause vomiting and griping, and, by propelling the contents of the bowel against the strangulated portion of the tube, distension and inflammation of the canal above the seat of the stricture. In omental rupture they cannot exert the slightest agency in extricating the protruded mass. Some benefit may be expected, especially in large and old hernias, from stimulating injections, as castor oil and turpentine, or senna and salts, used copiously by means of a gum-elastic tube carried high up the rectum. The peristaltic action thereby induced unloads the large intestine, and occasionally draws the strangulated portion of the canal into the abdominal cavity.

*Applications* made directly to the tumor and the parts immediately around are sometimes beneficial, both in effecting relaxation and relieving inflammation. With this view two classes of remedies, very opposite in their character, may be used, namely, cold and warm. Respecting their relative merits, it is impossible, in the existing state of the science, to form any accurate opinion. It is certain that they are not both equally applicable in all cases and in all circumstances. The best plan, undoubtedly, is to be governed, at least in some degree, in their employment, by the feelings of the patient, or the tolerance of the part and system. As a general rule, it will be found that cold applications will be borne best by the young and robust, and in cases of recent standing, whereas warm will be most agreeable when the patient is delicate and nervous, or old and feeble.

In my own practice I have derived most advantage from cold, applied by means of a small bladder partially filled with pounded ice, or a refrigerant lotion, composed of equal parts of alcohol and water, or a strong solution of nitrate of potassa and hydrochlorate of ammonia. When a sudden and powerful impression is desired, the tumor may be covered with a thin sponge, saturated with ether, or it may be irrigated with cold water, poured from a pitcher, or thrown upon it with a large syringe. Injections of ice-water might also be tried with a prospect of success. The external application of cold must not be too prolonged, as it has sometimes been followed by gangrene, especially in the aged and feeble. However employed, it seems to do good by diminishing the congestion in the vessels of the tumor, allaying morbid sensibility, moderating the tendency to inflammation in the protruded parts, relaxing the stricture, and, perhaps, also condensing any gas that may exist in the constricted bowel.

*Warm applications* are particularly soothing and useful when there is inordinate sensibility in the tumor and abdomen, along with an irritable state of the system and a disposition to nausea and vomiting. They may consist simply of water, or, what is better, of water and laudanum, kept constantly upon the parts by means of a large, thick flannel cloth, covered with oil-silk, and renewed at least every half hour, care being taken always to have a fresh cloth ready the moment

the previous one is removed. Warm applications relieve soreness and pain, and, if properly employed, relax both the parts and system, often inducing tranquil sleep and copious perspiration, during which the bowel has been known to return spontaneously into the abdominal cavity.

Although I am in favor of these applications in the milder forms of strangulated hernia, yet I should be very loth to employ them when there is the least urgency, or when the symptoms are such as to render the further postponement of the knife a matter of doubt. It should be remembered that they are at best merely adjuvants, and that by continuing them too long most valuable time may be lost. If, therefore, very decided amelioration do not promptly follow their employment, and, above all, if it be found, after they have been diligently plied for some hours, that the renewed efforts at the taxis are as unavailing as the previous, an operation should be performed with the least possible delay. That such a measure, however, is often necessary I am altogether unwilling to believe. On the contrary, I am satisfied from personal experience that, with the aid of anæsthesia, proper attention to the patient's posture, and a thorough knowledge of the anatomy of hernia, almost every case will be promptly relieved by the taxis. For years past I have not been obliged to use the knife in a solitary instance, even where the strangulation had existed for three, four, and five days, and where I had been requested by the attendant to bring my instruments for the purpose of operating. In most of these cases I have astonished the patient by the facility and promptness of the reduction, the absence of future suffering or inconvenience, and the rapidity of his recovery. It has long been the custom with some surgeons to operate in every instance of hernia after the slightest trial with the taxis, and in some of the foreign hospitals, as I learn from our medical journals, the employment of the knife seems to have become the rule, and the taxis the exception, recourse being had to it within five or six hours after the commencement of the strangulation. Such a procedure as this is certainly not justifiable when carried to such an extent, any more than too great a procrastination with the taxis.

Finally, it may be added that a patient has sometimes succeeded in effecting the reduction of his own hernia, after every effort with the taxis had failed in the hands of his attendant. Such an expedient is always proper if the person is intelligent, especially if he has been in the habit of relieving himself on previous occasions. Again, it is well known that our success with the taxis is sometimes more prompt and efficient if the abdominal muscles are rendered somewhat tense than when they are completely relaxed, as advised in a previous paragraph. Indeed, some practitioners, acting upon this knowledge, adopt this procedure in all cases. Lastly, I have often seen good effects follow the inordinate elevation of the pelvis, caused by suspending the patient, as he lies in bed, partially by his feet, and doubling up his body, thus producing the greatest possible degree of relaxation of the abdominal muscles, and also a certain degree of traction of the alimentary tube above the seat of the constriction.


In his effort at the taxis, the surgeon, instead of restoring the pro-





truded viscera to the abdomen, may push them upwards into a sort of artificial pouch in the cellular substance, between the transverse fascia and the transverse muscle, thus leaving them unrelieved; or, it may be, that the stricture is within the sac, instead of on the outside, and that, although replacement may have been effected, the strangulation continues as violently as before. Such cases are well calculated to embarrass the practitioner, but they admit of no delay. The proper plan, in the first case, is, to request the patient to use every possible exertion, by coughing and other muscular efforts, to reproduce the hernia, and, if he succeed in this, to proceed at once to the use of the knife. This failing, the surgeon, guided by his previous knowledge of the situation of the tumor, and the direction of the replacement, cuts down upon the parts, dividing layer after layer until he comes in contact with the disaffected viscera, which are then disengaged, and restored to their natural position. A similar procedure is adopted when the stricture exists within the hernial sac, and the protruded structures have been returned without relief of the strangulation.

Supposing that the taxis has succeeded, the patient must not be permitted at once to rise, and go about his business, particularly if the strangulation has been at all severe. In such a case recumbency is enjoined along with light diet and a full anodyne, until all danger of inflammation is over, when, resuming the use of his truss, he may get up and walk about.

*Operation.*—When an operation becomes necessary, the patient is placed upon his back, very much as during the taxis. The bladder having been emptied, the hair shaved off the part, and an anæsthetic

administered, an incision, linear, crucial, Y or V-like, or thus, ,

, , is made through the skin and superficial fascia, over the

most prominent portion of the tumor, commencing at its upper extremity, and terminating near its base, its length varying from two to three inches, according to the size of the hernia. The rule is always to have a large external wound, but a small internal one, pretty much as in the operation of lithotomy. Thus layer after layer is divided until the surgeon reaches the proper hernial sac, free use being made of the grooved director in exposing the deeper seated structures. The presence of the sac will usually declare itself by its bluish, vesicular appearance; but to dispel all doubt, a portion of it should be pinched up between the thumb and forefinger, and the opposite surfaces rubbed against each other, which cannot be done if it be anything else; or, to render the diagnosis still more certain, a puncture may be made into the part with a small needle. If this be followed by a drop of serous fluid it will at once decide the question. An opening just large enough to admit the point of the director, is now made, when, the instrument being carried upwards and then downwards, the sac is divided to the requisite extent, followed, of course, by the escape of its contents. It should be recollected that the quantity of fluid is always small in recent strangulation, and that cases occur where it is entirely absent, lest in our endeavors to find it the dissection should be carried too far. The

left forefinger (fig. 380), introduced into the bottom of the wound, now seeks for the seat of the obstruction at its upper extremity, and having found it, a probe-pointed bistoury is carried flatwise along its palmar aspect underneath the stricture, which is immediately divided by bringing the edge of the instrument, as seen in fig. 381, to bear against it. A little incision, not more than a line and a half in length, will generally answer the purpose. The dislocated viscera are now

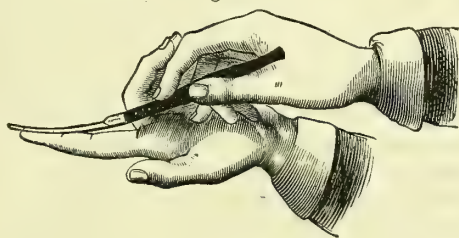
Fig. 380.



Fig. 382.

Fig. 383.

Fig. 381.



drawn away from the seat of the obstruction, and being found in a condition to be restored, are next carefully replaced into the abdominal cavity, the part that protruded last being reduced first, and the bowel before the omentum. The edges of the wound being approximated by several points of the interrupted suture carried through the muscular layers, the dressing is completed by adhesive strips, a compress, and a bandage.

The division of the stricture may be safely effected either with the hernia knife of Sir Astley Cooper (fig. 382), or with a common probe-pointed bistoury, represented by fig. 383.

It would almost be superfluous to say that the patient should be

most carefully watched after so serious an operation as that just now described. The treatment must be strictly antiphlogistic, and the probability of the occurrence of peritonitis must not be lost sight of for a moment. Much may be done in way of prevention in most cases by the administration of a full opiate immediately after the patient has been put to bed, and by close attention to the diet and bowels, which should not be permitted to be moved for several days, but should be kept in the most tranquil condition possible. Should peritonitis arise, as indicated by the excessive tenderness of the abdomen, the retracted limbs, the shrunk features, and the small, wiry, and contracted pulse, the proper treatment will be venesection, leeching, anodyne fomentations, and large doses of opium. When the patient has recovered, he must wear a truss until the parts have become completely consolidated, otherwise relapse will be inevitable.

*Examination and Treatment of the protruded Intestine.*—In the operation as now performed, it is supposed that the protruded parts are in a fit condition to be restored to their natural situation; but cases arise where the surgeon may entertain doubts in regard to the propriety of this procedure, or where such a course would be altogether improper. Much judgment and experience are frequently required to enable him to decide the question correctly, and to act with the promptness and certainty which should characterize his efforts for his patient's relief. On the one hand, he may return parts actually in a state of gangrene, and thus inevitably kindle the flames of a fatal inflammation; or, on the other, he may, for want of proper knowledge, cut into the bowel and excise the omentum when they are in a condition to be safely replaced. Actual inspection is, in general, the only reliable source of information on such occasions, but valuable aid is occasionally furnished by extraneous circumstances, as the history of the case, the small size of the swelling, the duration of the strangulation, and the condition of the system. Thus, when the hernia is small and recent, the danger of mortification is always greater than when it is large, or large and old; it is also greater when the strangulation has been protracted than when it is recent, and the probability of its existence is almost converted into certainty when, after the ordinary phenomena of strangulation, there is a Hippocratic appearance of the countenance, a feeble, tremulous pulse, hiccough, and a crackling state of the tumor, with a sudden cessation of pain and excessive prostration of the vital powers.

The hernial sac having been exposed, and the stricture divided, the parts are gently drawn down, preparatory to a thorough examination of their condition. In all cases, whatever may have been the duration of the strangulation, there will be more or less injection of the vessels of the protruded structures, rendering the former unnaturally conspicuous, and heightening the color of the latter. The vascularity of the bowel is always, in the milder forms of the accident, arborescent, that is, the vessels are spread out over the surface of the tube in dendritic lines, and the accompanying discoloration is so slight as to be scarcely distinguishable from the normal appearance; but whenever the constriction has been severe or long-continued, the vessels



assume a capilliform arrangement, and the peritoneal lining of the intestine exhibits a claret, purple, or blackish hue, with, perhaps, here and there a slight ecchymosis. The discoloration, in either case, may be diffused or circumscribed, uniform or diversified; generally the latter.

When the discoloration is slight in degree, although it may be extensively diffused, it may be assumed that the bowel is in a condition to be returned, especially if, after having been emptied of its blood, the vessels are speedily refilled. If, on the other hand, the bowel is very dark, purple, or almost black, the presumption will be strong that there has been great derangement of the circulation, if not actual stagnation of the blood, and replacement should not be attempted unless there is reason to believe that the part will be able to recover from the effects of its compression. To determine this question, one of the most serious that can arise during an operation, the intestine, after having been thoroughly liberated, should be fomented with a sponge or cloth wrung out of warm water, and steadily maintained in contact with it for ten, twelve, or fifteen minutes; if it be found at the end of this time that there is no change in the appearance of the protruded knuckle, denotive of a return of its circulation, it will be proper to puncture some of its vessels, or even to scarify the bowel very slightly at a few points. If no blood issue, the probability is that the tube is mortified, and this probability is converted into positive certainty, if, superadded to this, there is a softened condition of the parts, an absence of all sensibility, and a total loss of temperature. Much stress has been laid by surgeons upon the greenish or ash-colored appearance presented by the bowel in strangulation, but my conviction is that its importance has been greatly magnified, and that, unless it be combined with other changes, especially changes of consistence, it should not be considered as an evidence of mortification.

When mortification has actually taken place, then, of course, the bowel is not returned, but freely opened to afford an outlet to its contents, the stricture having been previously relieved in the ordinary way. It has been objected to this procedure that it has a tendency to break up the adhesions which the intestine has formed to the edges of the hernial aperture, but such a conjecture is altogether hypothetical, and the practice founded upon it should, therefore, be disregarded. During the progress of the inflammation which precedes the mortification, the bowel is always firmly glued to the adjacent parts, and hence the incision necessary to liberate it never permits the extravasation of fecal matter into the peritoneal cavity. To leave the stricture undivided would be to afford only partial relief, not only as it respects the symptoms of the strangulation, but also the evacuation of the tube, and might thus lead to the necessity of another operation, at a period, perhaps, when such a procedure might seriously disturb both the part and system. The wound is afterwards left open, and covered with warm water-dressing, fetor being allayed by the use of the chlorides.

No surgeon, now-a-days, thinks of excising the mortified portion of bowel, and uniting the tube by the interrupted suture. Such a procedure would be attended with great risk, and has, therefore, very properly fallen into desuetude. Nor is it necessary, as it was once

deemed to be, to secure the bowel to the external wound by a stitch through the mesentery, since, as has been already seen, the adhesion between it and the edges in the hernial aperture is always sufficiently firm to prevent its separation, and, consequently, the occurrence of fecal extravasation into the peritoneal cavity.

It has been proposed, when the mortification is very limited, to replace the bowel instead of opening it, as when the mischief is more extensive, on the supposition that, before the slough can separate, the parts immediately around the seat of the disease will have contracted firm adhesions to the neighboring viscera, thus protecting the peritoneal cavity against fecal effusion. The propriety of such a measure may well be doubted, and I should, therefore, discountenance its adoption, knowing as we do that a dead tissue, if brought in contact with a living one, must always act as a foreign substance, and that, although it might induce a deposition of lymph on the surface in its vicinity, yet the adhesions thus formed might not be strong enough to resist either the peristaltic movements of the bowel, the efforts of the abdominal muscles, or the pressure of the abdominal viscera.

Instances occur in which the bowel is ulcerated, in consequence of the compression exerted upon it by the stricture. Only one opening may exist, or the part may be pierced at a number of points, not larger, perhaps, than so many pin-heads, and separated by more or less healthy tissue. In the former case, the aperture, if not more than two lines or two lines and a half in diameter, may be included in a delicate ligature tied firmly around a tenaculum, the ends being afterwards cut off close to the knot, to enable it to discharge itself into the bowel, and pass off with its contents; otherwise the part must be treated as if it were mortified. A similar practice is adopted when the intestine has a riddled, cribriform appearance; because here it would not be possible to tie up each aperture, and yet not safe to return the viscus without such a precaution.

Sometimes, again, the bowel is circularly indented by the stricture, as if it had been compressed by a tightly drawn cord. In this way its circulation may be much embarrassed, if not completely suspended, followed by ulceration and even gangrene. The serous coat possessing greater resisting power than the others, usually retains its integrity longest, and the rule, therefore, is to return the viscus if its appearance is such as to justify the belief that it will become promptly adherent to the neighboring organs; otherwise to treat it as if it were sphacelated.

Finally, the bowel may have contracted adhesions to the inner surface of the sac, thus rendering its restoration difficult, if not impracticable. The mode of procedure varies according to the nature of the union, as to whether it is recent or old; in the former case, it will be easily broken up with the finger or handle of the scalpel, when the viscus, if otherwise in a proper condition, is at once replaced; in the latter, the liberation may be effected by a careful dissection, provided the adhesions are not very extensive, in which case the bowel, after having been freed by the division of the stricture, should be left in its extra-abdominal situation. When the adhesions are very firm, but limited, it has been suggested to dissect up the corresponding portion of

the sac, and to return it along with the bowel; but in performing such an operation the greatest caution is necessary, otherwise the part may act irritatingly, and thus cause serious mischief.

Sometimes there is a firm and intimate adhesion between the bowel and the stricture, extending round their entire circumference, and seriously interfering with the latter's division. The practice under such circumstances has been to incise both bowel and stricture; but this need surely never be done if proper care and patience be exercised, for by a little management the surgeon will always either find, or, at all events, will be able to make, a little opening between the parts for the insertion of his director or probe-pointed bistoury. It is only when the adhesions are very old and firm that any real difficulty can arise, and even that may always be comparatively easily overcome by a little dissection.

*Examination and Treatment of the Protruded Omentum.*—Various circumstances may arise to render it improper to reduce a strangulated omentum, among which the principal are inflammation, mortification, hypertrophy, and morbid adhesions. It is well known that this body is much less capable of resisting the effects of inflammation than the intestine; hence it is, not unfrequently, in a condition not to be replaced when the other is, especially when it is loaded with fat, as it nearly always is in corpulent subjects, and when the slightest compression almost is sufficient to deprive it of vitality. The discoloration of an inflamed omentum is always less than that of an inflamed bowel, and its vessels, instead of exhibiting an arborescent arrangement so conspicuous in the latter, usually present themselves in straggling, perpendicular lines. Conjoined with these changes, there is always, particularly in the more violent and protracted forms of strangulation, well marked loss of consistence in the protruded part, so that the slightest pressure of the finger is sufficient to convert it into a pulpy mass.

The tests for ascertaining the vitality of a strangulated omentum are similar to those which we have described for judging of the vitality of a strangulated intestine; but it should be borne in mind, as was before stated, that a highly inflamed omentum is much more liable to die after it has been replaced than a correspondingly inflamed bowel; and hence, if its vessels are not speedily refilled after their contents have been pressed out, or the circulation do not afford evidence of returning vigor under the use of fomentations, no attempt should be made at restoration, lest the strangulated mass, acting as a foreign substance, should induce fatal peritonitis. Instead of this, the whole of the affected membrane is excised, and each artery is included in a separate ligature, one end of which is cut off close to the knot, and the other brought out at the wound, where it is secured by an adhesive strip. Before so important an operation is performed, the omentum should be carefully unrolled, for it has occasionally happened that it has contained a loop of intestine, which might thus be opened by the knife, much to the detriment of the patient and the dismay of the surgeon. To prevent it from being drawn up into the abdomen before its vessels are secured, it should be firmly held by an assistant, either with the fingers or by means of a temporary ligature.



Retrenchment will also be required when the omentum is much enlarged by interstitial deposits, rendering it impossible to replace it; or when, if restored, it would be likely, on account of its inordinate bulk and tuberculated surface, to cause violent peritonitis. Such a procedure is far preferable to that of leaving the protruded part in the hernial sac, in the hope of preventing thereby a recurrence of the rupture; a circumstance which, although possible, is not at all probable, and which, even if it did occur, would hardly compensate the patient for the severe dragging sensations to which he would ever after be exposed in consequence.

An adherent omentum is treated upon the same principles as an adherent bowel, only that greater liberty may be taken with it when the adhesions are old, in which case it may not only be extensively dissected away from the sac, but, if necessary, cut off, in the same manner as in mortification and hypertrophy, already described.

A strangulated hernia sometimes becomes the seat of an *abscess*, the inflammation occasioned by the constriction terminating in suppuration. Such an event is most common in hernia of long standing, attended with the formation of a large sac, and the adhesion of the protruded structures to its inner surface. The immediate cause of the deposition of matter may be the constriction itself, the compression of the sac by the imprisoned viscera, or, finally, some external injury, as a blow, or twist, or rough manipulation, inflicted during an attempt at reduction. The matter, which occasionally forms very rapidly, is of a sero-purulent character, and is sometimes quite profuse, amounting to many ounces. If the patient survive for eight or ten days, the fluid gravitates towards the most dependent portion of the tumor, where it may readily be detected by the distinct sense of fluctuation which it imparts to the fingers, by the exquisite pain and tenderness it produces on pressure, and by the red, oedematous condition of the integuments. In some cases, the matter breaks through its confinement, and finds its way by ulceration to the nearest surface. I have known an abscess to form when the protruded part consisted exclusively of bowel, but the occurrence is by far most common when the hernia is omental, or omental and intestinal.

The termination of such an abscess is variable. The matter may be evacuated, and the patient make a good recovery, the parts being resolved immediately after the fluid has been drawn off, or the pus may escape into the peritoneal cavity, and cause fatal inflammation; or an opening may form externally, admitting of the discharge both of matter and of feces, as when the bowel has been invaded by gangrene; or, finally, the abscess may be emptied by puncture, but, the constriction remaining unrelieved, the patient may perish under symptoms of strangulation.

In any event, a hernial abscess must be considered as a serious complication, both as it respects the fate of the patient and the nature of the diagnosis, which is often extremely difficult and perplexing. The proper treatment, of course, is to lay the sac freely open, to evacuate the purulent fluid, to relieve strangulation, and to restore the protruded structures to their natural position.

*Division of the Stricture External to the Sac.*—This procedure, originated upwards of a century ago, has many advocates, especially in England, where it has received much attention within the last fifteen years, chiefly through the influence and writings of some of the London surgeons. In this country it has probably not attracted as much notice as it deserves. The great advantage of it is that, as it does not interfere with the proper hernial sac, it is much less liable to be followed by peritonitis, which constitutes the great source of danger in the ordinary operation. Added to this, it is generally more easy of execution, and attended likewise with less risk of injury to the intestine. On the other hand, the stricture may exist within the sac itself, and hence the parts might be returned without being relieved; a result, the effects of which would only be too certainly fatal. The cases to which the method is more particularly applicable are, first, where there is reason to believe, from the character and duration of the symptoms, that the strangulation cannot be dependent upon the presence of plastic adhesions, but that it is caused by the edges of the hernial aperture; and, secondly, where the tumor is old and has been long irreducible, and where, consequently, if the stricture be internal, relief may be afforded by a subsequent operation.

It would not be proper, in the existing state of our knowledge, to pronounce a decisive judgment upon a subject of so much importance as this unquestionably is; we must wait for further data, and, in the meantime, adopt the rule to lay open the proper hernial sac whenever there is any reasonable doubt in regard to the site of the stricture.

*Accidents.*—The principal accidents that are liable to happen during this operation are wounding of the intestine and hemorrhage. Formerly these accidents were not infrequent, but they certainly are at the present day, owing, no doubt, to our improved knowledge of the anatomy of the different varieties of hernia, and of the relative position of the bloodvessels. Wounding of the intestine is generally the result of sheer carelessness, but hemorrhage may occur in the hands of the most skilful operator, and may, therefore, be considered as, in some degree, unavoidable, whatever may be the precautions exercised in making our incisions and in dividing the stricture.

A wound of the bowel will be denoted by the escape of gas, feces, mucus, or ingesta, and, unless extensive, will not add materially to the danger of the operation. If it be very small, as, for instance, not more than a line and a half in length, it may be hooked up with the tenaculum, and embraced by a fine ligature, the ends of which are cut off close to the knot. If the incision be more extensive, the interrupted, Lembert's, or the glover's suture, must be used, as in ordinary wounds of the bowel. The tube is then replaced, and the case treated upon general antiphlogistic principles.

The hemorrhage may proceed from injury of the epigastric, obturator, or spermatic artery, and is sometimes alarmingly profuse. In operating for strangulated femoral hernia, the femoral or saphenous vein has occasionally been wounded, but such an occurrence implies great carelessness, and never happens to a skilful surgeon. When the bleeding is external, the vessel from which it proceeds may occasion-

ally be exposed simply by everting the edges of the wound, or drawing down the neck of the hernial sac; this failing, it is sought for with the knife. The same plan is pursued when the hemorrhage is internal, the wound being enlarged, more or less freely, with the probe-pointed bistoury. Sometimes the flow of blood is readily arrested by systematic compression, made with the compress and bandage, or by means of the finger of a relay of assistants.

Lastly, the protruded parts, instead of being restored to the abdominal cavity, may be engaged in the cellular tissue between the transverse fascia and transverse muscle, where, the strangulation continuing, they may become a source of fatal mischief. To prevent this occurrence, the finger should always, if possible, be carried into the belly, and gently moved about, to ascertain that the viscera are in their proper situation. Should this be found not to be the case, every effort should be made to liberate them; with the finger, if practicable, with the knife, if not. To leave them in their new position, would be almost certain death.

## SECT. II.—HERNIAS OF PARTICULAR REGIONS.

The principal varieties of hernia are the inguinal, scrotal, femoral, and umbilical, to which may be added the rarer forms of obturator, sciatic, perineal, pudendal, vaginal, and diaphragmatic.

### INGUINAL HERNIA.

When the contents of the abdomen pass out at the groin, the complaint constitutes what is called an inguinal hernia, or a rupture of the groin. Of this affection there

Fig. 384.



Plan of inguinal hernia; on the right side oblique, on the left direct. *a.* The hernial sac. *b.* The epigastric artery.

are two distinct varieties, namely, inguinal hernia by the oblique descent, and inguinal hernia by the direct descent (fig. 384), each of which demands separate consideration.

*Oblique Inguinal Hernia.*—Oblique inguinal hernia derives its name from the fact that it pursues the course of the spermatic cord in the male, and of the round ligament in the female. It is of more frequent occurrence than all the other varieties of the complaint put together; is met with chiefly in men, and is more common on the right side than on the left. The reason why this form of hernia is so much more frequent in men than in women, is the greater relative size of the inguinal rings



and canal in the former than in the latter, thus constituting a powerful predisposition to the disorder. Another reason, doubtless, is that men are much more exposed to all kinds of hardships, involving inordinate muscular exertion. The situation of the liver has usually been assigned as the cause of the greater frequency of hernia on the right side than on the left, the pressure which it exerts upon the alimentary tube, and through it upon the inguinal region, being much greater than that exerted by the spleen. As another cause of the difference, though probably not a very efficient one, may be mentioned the circumstance that most persons are right-handed, thereby keeping the right abdominal walls more constantly in a state of tension, especially in the working classes, among whom inguinal hernia is so common. Occurring at all periods of life, it is produced by the same causes as ruptures in other situations, and may be complete or incomplete, according as the parts protrude or not at the external ring.

In complete oblique inguinal hernia the viscera enter the internal inguinal ring, and descending along the inguinal canal, emerge at the external ring, forming thus a tumor in the groin, immediately over Poupart's ligament, and just outside the spine of the pubes. Varying in volume from that of a pigeon's egg to that of the fist, it is usually of a globular form, and of a soft consistence, receiving a distinct impulse on coughing, and receding during recumbency, but reappearing in the erect posture.

*Diagnosis.*—The diagnosis of this variety of hernia may be obscured by various affections liable to occur in this situation, among which the most common are hydrocele of the spermatic cord, imperfect descent of the testicle, diseased lymphatic ganglions, and psoas abscess. An oblique inguinal hernia, so long as it remains in a reducible state, can, in general, easily be distinguished from other affections; but the case is very different when it becomes irreducible or strangulated. Then the most experienced surgeon cannot always determine, without the greatest care, the precise nature of the complaint.

An encysted *hydrocele* of the spermatic cord is generally small, not exceeding the volume of a pigeon's egg, round or ovoidal, tense and elastic, uniform in its consistence, fixed in its situation, and distinctly translucent when viewed against the light. These characters, together with its history, are sufficient to distinguish it from hernia, provided it is below the external ring, but when it is above this point, under cover of the tendon of the external abdominal muscle, some difficulty may be experienced in discriminating between it and hernia. When this is the case, a small exploring needle will generally furnish the requisite information.

An imperfectly descended *testis* might be mistaken for an oblique inguinal hernia, especially if it were to lie, as it sometimes does, partly within and partly outside the external ring. Its ovoidal form, however; its constant, unvarying volume; its firm consistence, and the peculiar sickening sensation produced by compressing it, together with the history of the case, and the absence of all disturbance of the intestinal tube, will hardly admit of the possibility of confounding the two complaints with each other.

An inflamed *lymphatic ganglion* might be mistaken for an inguinal rupture, and the diagnosis might be still further embarrassed by the co-existence of the two diseases. Enlargement of the absorbent glands of the groin may result from various causes, of which, however, the most common are gonorrhœa and chancre, leading often to a great deal of tenderness, pain, and swelling, followed, in time, by suppuration and abscess. In the early stage, the affection might be mistaken, especially by an incautious observer, for an inguinal hernia. In general, the enlargement is easily recognized by its situation, which is oftener below than above Poupart's ligament, by its defined, circumscribed character, by its mobility, and by our being able, when the tumor is grasped, to lift it away, as it were, from the subjacent parts; circum-

Fig. 385.



Hernial sac, showing its usual situation in front of the spermatic cord.

stances which, joined to the history of the case, will usually serve to show that the tumor is not a hernia.

Another source of doubt in this affection is *psaos abscess*, which, as it progresses, often points just above Poupart's ligament, generally, however, nearer to the anterior superior spinous process of the ilium than to the pubic symphysis, which is not the case in complete inguinal hernia, whether by the oblique or direct descent. In *psaos abscess*, moreover, the patient is always somewhat lame on the corresponding side, and there is more or less derangement of the general health prior to the occurrence of the doubt in the diagnosis. Besides, in strangulation the tumor is fixed, whereas in *psaos abscess* it is movable, receding under pressure, and disappearing measurably or completely during recumbency.

In oblique inguinal hernia the spermatic cord is situated behind the tumor (fig. 385), the epigastric artery lying on its inner side, close to its neck. As it proceeds downwards to its place of destination in the groin, it clothes itself, in addition to its proper sac, with the infundibuliform process of the transverse fascia, the fibres of the cremaster muscle, the spermatic fascia, superficial fascia, and skin. Hence, every such hernia may be said to have six coverings, which, in cases of long standing, are generally quite thick and closely matted together, but often very thin and indistinct in those of recent formation. I recollect operating, some years ago, upon a strangulated inguinal hernia, where the coverings of the tumor consisted only of the skin and the merest film of cellular tissue. In old ruptures, on the contrary, especially in those of large bulk, a tedious dissection is often necessary before we can reach the proper hernial sac, skin, fascia,

muscular and aponeurotic fibres being all in a state of thickening, induration, and condensation from interstitial deposits.

In recent oblique inguinal hernia, the internal ring occupies its accustomed situation, that is, it is midway between the anterior superior spine of the ilium and the pubic symphysis, and this, therefore, is the point where the pad is to rest in the reducible form of the affection; but in cases of long standing and of great bulk, the opening undergoes important changes in its relative position, being dragged down just behind the external ring, the intervening canal itself being effaced. The ring, moreover, under these circumstances, is generally very much enlarged, and of an annular form, so as to admit very readily the extremity of a big finger. A knowledge of these changes is of the greatest importance both in relation to the taxis and the operation for strangulated hernia.

The contents of this variety of hernia usually consist of a knuckle of the ileum, either alone, or in union with a portion of omentum; sometimes of the arch of the colon, and occasionally of the cæcum, the sigmoid flexure of the colon, and of the urinary bladder. The disorder may co-exist with inguinal hernia by the direct descent, femoral hernia, or umbilical hernia. In one case an inguinal and a femoral hernia were found on each side of the same person.

*Treatment.*—For the reducible oblique inguinal hernia a well constructed truss is used, the pad being of an ovoidal shape, arranged obliquely in reference to its spring, and applied in such a manner as to compress the internal ring. The precise point upon which, in recent cases, the pad should rest is about four lines above Poupart's ligament, equidistant between the pubic symphysis and the anterior superior spinous process of the ilium. In cases, however, of long standing, where the two openings are on the same plane, the pressure must obviously be made lower down, as well as farther in towards the median line, or, to speak more definitely, directly in the situation of the outer ring. The block, too, should be somewhat larger, in order that its influence may be more widely diffused.

The irreducible oblique inguinal hernia is treated upon the general principles laid down in the previous section, care being taken to give due support to the parts by means of a suspensory bag, or a hollow truss, worn day and night. In this way the hernia is prevented from increasing, at the same time that it is measurably protected from harm.

In the event of strangulation occurring in this variety of hernia, the *taxis* is to be employed in strict conformity with the direction of the descent. Thus, in recent cases, where the rings retain their natural position, the parts are pushed obliquely upwards and outwards, in the course of the inguinal canal; whereas, under opposite circumstances, the pressure is made directly upwards, or upwards with a slight inclination outwards. Unless the strictest attention be given to these rules, the surgeon may find it extremely difficult, if not impossible, to attain his object. In regard to the position of the patient, it should be in strict accordance with the instructions laid down under the general observations upon this subject.

Should the taxis fail, and an operation become necessary, the *stricture* will generally be found at one of three situations; at the internal ring, within the canal at the edge of the transverse and internal oblique



muscles, or at the external ring. In old and large hernias, the obstruction is usually at the latter point; whereas, in small and recent, it is commonly at one or the other of the former. However this may be, the finger will always readily detect it as soon as the proper hernial sac has been sufficiently exposed to receive it. In dividing the stricture where no doubt exists as to the precise nature of the descent, the direction in which the knife should be carried is obvious enough, being in the one case obliquely upwards and outwards, and in the other directly upwards; but when it is uncertain whether the hernia was originally one by the oblique or straight descent, the safest rule, as it respects the epigastric artery, is to cut directly upwards, inclining the knife neither to one side nor to the other. For, should the hernia be one by the direct descent, and the surgeon carry his instrument upwards and outwards under the idea that the hernia was oblique, he would almost inevitably injure the vessel in question, and thus lead to a very embarrassing, if not a fatal hemorrhage. The rule, here described, then, should be most scrupulously observed in all cases of doubt.

The direction of the external incision must vary according to the nature of the descent, and may be simply a linear one, as when the tumor is very small, or T-like, or crucial, if it be large. The dressings and after-treatment are in every respect the same as under ordinary circumstances.

*Incomplete Oblique Hernia.*—The incomplete inguinal hernia has received different names, expressive either of its situation or of its obscure character, as interstitial, interparietal, and concealed. The term incomplete is, perhaps, as proper as any other, and may, therefore, be employed to their exclusion, the more especially as we shall thus remove one source of confusion.

In this variety of hernia, which is merely a subdivision of that just described, the abdominal viscera pursue the same course, only that they do not pass out at the outer ring; indeed, very frequently they do not even descend nearly so low down. I have seen several instances where the hernia consisted of less than half the circumference of the bowel, which projected scarcely half an inch into the inguinal canal, and which, consequently, did not form the slightest appreciable tumor in the groin. Such an occurrence is always peculiarly dangerous, from its great liability to be overlooked when it becomes strangulated. In the cases adverted to all the patients perished, because the true nature of the complaint was overlooked on account of the absence of anything like an external tumor. Dissection revealed the presence of severe peritonitis and the existence of a stricture just within the inguinal canal. In one of the cases it seemed to have been formed by the edges of the internal ring pinching the inclosed bowel.

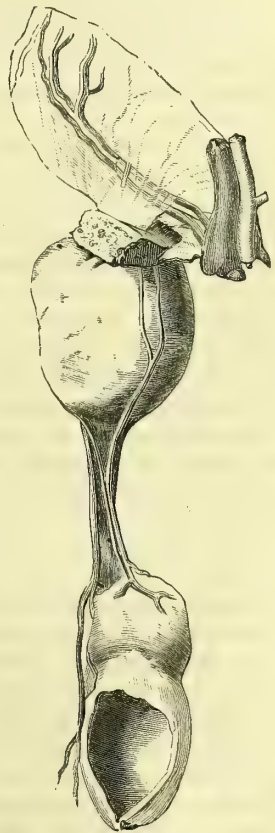
In general, however, the protrusion is more voluminous, and often consists both of bowel and omentum, passing down some distance into the canal, and forming a well-marked prominence externally; liable to be mistaken for encysted hydrocele of the spermatic cord, psoas abscess, or an imperfectly descended testicle; and, when strangulated, tender under pressure, painful, resisting the taxis, and attended with great constitutional distress. The mode of determining the diagnosis

is similar to that of ordinary oblique inguinal hernia, but additional solicitude should be felt when, if strongly marked symptoms of strangulation exist, there is no tumor in the inguinal region, or in any of the usual sites of rupture. In such a case the most thorough scrutiny should be instituted, and it would be good practice where there is no outward evidence of the affection, to put the patient in the proper position for the taxis, and to use the same means for effecting reduction as if we were positively assured of the presence of hernia. I should, in such an event, place no little reliance upon any tenderness that I might discover at or near the internal ring, as a guide to the course to be pursued for the relief of my patient. Even if it were only slight, but circumscribed, a judicious surgeon would hardly hesitate, especially when everything else is clearly denotive of the existence of strangulation, to use the knife, well knowing that no great harm could result from it, even if the operation proved a failure; whereas, if a hernia really existed, it would be the only proper procedure after a fair trial of the taxis.

The coverings of this variety of hernia are, examining the parts from without inwards, the skin and superficial fascia, the tendon of the external oblique, the cremaster muscle, and the infundibuliform process of the transverse fascia, together with the proper sac. The stricture is usually formed by the edge of the internal oblique and transverse muscles, and should be divided by carrying the knife obliquely upwards and outwards, as we shall thus effectually avoid the epigastric artery, which always lies on the inner side of the tumor. When the included portion of bowel is very small, the seat of the constriction will generally be at the internal ring or at the mouth of the sac. The spermatic cord always bears the same relation to the protruded parts as in complete oblique inguinal hernia.

*Direct Inguinal Hernia.*—Inguinal hernia by the direct descent, or ventro-ingual hernia, as it is sometimes denominated, is comparatively infrequent, especially in the female, in whom it is so rare that many surgeons even in large practice never see an instance of it. Possibly it may be more common than is generally supposed, but being difficult of diagnosis, it may not always, or, perhaps, even ordinarily, be in our power to distinguish it from the oblique form of the complaint. In this variety of rupture, the viscera descend immediately behind the external inguinal ring, passing either below the trans-

Fig. 386.



Direct inguinal hernia; showing the mouth of the sac lying on the pubic side of the deep epigastric vessels.

verse and internal oblique muscles, or through an opening, usually somewhat slit-like, in their fibres. The epigastric artery (fig. 386) and spermatic cord lie on the outside of the sac, though occasionally the latter is placed in front, or even on the inside of the tumor, but this is the exception, not the rule. Its coverings consist of the skin and superficial fascia, the spermatic fascia, some of the fibres of the cremaster muscle, a prolongation of the transverse fascia, and, lastly, of the proper sac. Sometimes a few straggling fibres of the transverse and internal oblique muscles are sent down over the tumor, and thus serve to give it a partial investment. The tumor is of the same volume, shape, and consistence, as in oblique inguinal hernia, and is distinguished from other affections of the groin in the same manner. It is usually composed of bowel alone, the omentum entering less frequently into its formation than in the more common variety of inguinal rupture.

In employing the truss for the relief of this form of hernia, care must be taken to apply the pad directly above the external ring, a point which, it will be perceived, is considerably further down and inwards than in a recent oblique hernia. When strangulation occurs, the parts are pushed directly upwards and backwards, or, if the tumor be small, directly backwards, the same precautions being observed in regard to the position of the body and limbs of the patient as in the other varieties of inguinal hernia. Should an operation become necessary, the stricture will be found either at the external ring, or at the inferior edge of the transverse and internal oblique muscles, and is to be relieved by carrying the knife directly upwards, it being borne in mind that the epigastric artery is on the outside of the tumor. This precaution is so much the more necessary, inasmuch as it is not always easy to determine whether the rupture is one by the direct or oblique descent. Thus, if the surgeon, in dividing the stricture, were to incline the knife inwards under the supposition that he had to deal with a direct hernia, but which proved to be an oblique one, the result would almost inevitably be a wound of the vessel under consideration; hence, in order to avoid such a contingency, the best course to be adopted, in all cases, is to carry the instrument directly upwards without the slightest deviation to either side.

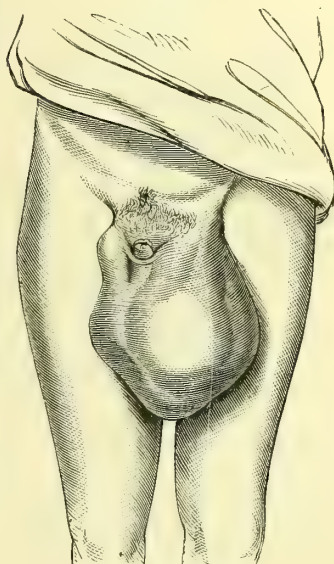
#### SCROTAL HERNIA.

Scrotal hernia is, strictly speaking, merely a form of inguinal hernia, the abdominal viscera, instead of stopping in the groin, passing down into the scrotum. The difference, it will thus be perceived, is one altogether of degree, not of kind. The affection is sometimes congenital, but most commonly it is acquired, or brought about under the influence of muscular exertion, elderly subjects being most liable to it. The contents of the hernia are various; consisting at one time of bowel alone, at another of omentum alone, and in a third series of cases, and these are perhaps the most frequent, of the two conjoined, the former in this event always lying behind the latter. The shape of the tumor is generally ovoidal, or pyriform, but instances occur in which it is cylindrical, conical, or hour-glass like. Its volume is



occasionally enormous; in a case which I treated some years ago it was twelve inches in length, and nearly two feet at its widest part, which was at its middle. In another case the tumor was still larger, descending nearly as low down as the knee, and being of proportionable diameter. Whenever the hernia is of unusual bulk, the penis is either partially or completely buried in its substance, thus interfering with copulation, and even with micturition. Whatever may be its form and size, the testicle is situated at its base, the spermatic cord being at its upper and posterior extremity. The ordinary appearances of a scrotal hernia are well depicted in the annexed drawing (fig. 387), from a patient at my Clinic.

Fig. 387.



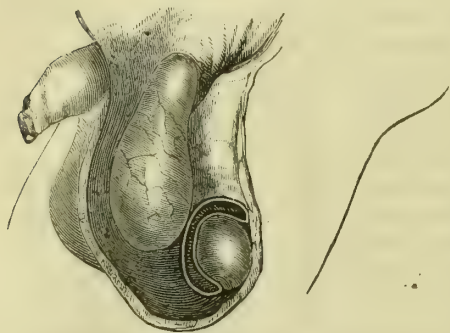
Large scrotal hernias are almost always irreducible, or, if they are not so originally, they are sure to become so ultimately. The most common causes of this occurrence are plastic adhesions between the protruded parts, or between these and the inner surface of the sac; but it happens also not unfrequently from a kind of sarcomatous enlargement of the omentum, interfering with its return through the inguinal rings. A hypertrophied state of the bowel itself may be mentioned as another circumstance that may render a hernia originally reducible in time irreducible. However this may be, the patient generally experiences dragging sensations and colicky pains in the abdomen, and the bowels are almost always habitually constipated. The tumor is firm, but somewhat elastic to the touch, and quite tolerant of manipulation, except when inflamed or irritated by exercise.

The coverings of an old scrotal hernia are often very thick, dense, and firm, and not easily distinguishable from each other in case of an operation. The proper sac lies in immediate contact with the testicle, and, to reach it, it is necessary, in addition to the skin, to divide the dartos, which answers here to the superficial fascia, the spermatic fascia, the cremaster muscle, and the infundibuliform process of the transverse fascia. No vessel of any importance is involved in its anatomy; in old and large scrotal hernias, however, the external pudic artery is often much enlarged, and consequently capable of furnishing a considerable hemorrhage.

*Diagnosis.*—Scrotal hernia is liable to be confounded with other affections, particularly with hydrocele, varicocele, and sarcocele, chiefly, however, in its earlier stages; for, when the complaint is well established, it is almost impossible to mistake its real character, except by the most superficial examination. From *hydrocele* it may generally be easily

distinguished by the following circumstances. Hernia always begins above, showing itself, in the first instance, as a tumor in the groin, from which it gradually descends into the scrotum. In hydrocele the

Fig. 388.



A scrotal hernia; showing the usual relation of the sac to the vaginal tunic.

reverse is the case, the swelling commencing below, and gradually extending upwards. In hernia the tumor is irregular in shape, generally more or less flattened in front and behind; whereas in hydrocele it is usually pyriform, being larger below than above. In hernia the testicle is at the bottom of the tumor; while in hydrocele it is at its posterior surface, commonly above the junction of the inferior with the two superior thirds, though this arrangement is by no

means constant; for in many cases of hydrocele the organ lies at the base of the swelling. In hernia the tumor is doughy, or gaseous, not elastic and fluctuating as in hydrocele; opaque, and not translucent; in the former the patient usually experiences disagreeable dragging sensations and colicky pains, especially when the protrusion is very large; while in the latter he suffers no inconvenience save what results from the volume and weight of the swelling. In reducible hernia the contents of the tumor are easily replaced when the patient is recumbent, but redescend the moment he resumes the erect posture; while in hydrocele no such changes can possibly occur, whatever may be the posture. When we add to these symptoms the fact that the spermatic cord is always behind the protruded parts in hernia, and, consequently, much less distinct in its outline than in hydrocele, in which it can almost always be felt as a firm, rounded body at the upper extremity of the tumor, and the circumstance that the opening through which the rupture has taken place can always be satisfactorily traced with the finger, while in hydrocele the inguinal rings retain their natural form; we shall have no difficulty, at least in the majority of instances, in arriving at a correct decision. Much valuable information may also be derived from the history of the case, and from the use of the exploring needle, which, whenever there is any doubt about the matter, will not fail to afford the requisite light.

Scrotal hernia can always be readily distinguished from *varicocele* by the peculiar feel which the enlarged veins in this disease impart to the finger, which is similar to that of a bundle of earth-worms, or of the intestines of a squirrel; by the bluish appearance of the tumor; and by the circumstance that the swelling, after being effaced, is always promptly reproduced when the patient is placed erect, and pressure is applied to the external abdominal ring. In reducible hernia, on the contrary, such a procedure necessarily prevents the reproduction of the tumor. In hernia, moreover, the swelling receives a distinct im-

pulse under coughing and other muscular exertion; while in varicocele the parts are perfectly passive.

In *sarcocele* the best guides are the history of the case, the uniform hardness of the swelling, the normal state of the abdominal rings, the inability of the surgeon to affect the volume of the tumor by manipulations, and the indurated and distended condition of the scrotum. When the disease is associated with hydrocele, a part of the tumor will be likely to be translucent, soft, and fluctuating; thus strikingly contrasting with the remainder.

Solid tumors—fibrous, adipose, sebaceous, cystic and encephaloid—developed in the scrotum, testicle, or vaginal tunic, are, in general, easily distinguished by their progress, by their form and consistence, by the nature of the local distress, and by the presence or absence of constitutional involvement.

*Treatment.*—Scrotal hernia, whether reducible, irreducible, or strangulated, is treated upon the same general principles as hernia of the groin, of which, as was stated before, it is merely a continuation. A suitable truss is the proper remedy for the reducible variety, and the prospect of a permanent cure under its influence will be in proportion, all other things being equal, to the recency and small size of the tumor. The pad is, of course, placed over the internal ring, or, in cases of long standing, just above the external, the relative position of the two apertures under such circumstances not being forgotten. When the hernia is irreducible, it should be supported, both day and night, by a suspensory bandage, provided with shoulder-straps, otherwise it will answer the purpose but indifferently. By means of such an apparatus the patient will be relieved of much of his inconvenience, at the same time that the tumor will be protected from further increase. Great attention should also be paid to the bowels, which should be constantly maintained in a soluble condition. The diet should be plain and simple, easy of digestion, and comprised in the smallest possible bulk, lest the alimentary tube should suffer from flatulence and fecal distension. All violent bodily exertion, fatiguing walks, and exercise on horseback must be avoided. The taxis, in case of strangulation, is conducted in the usual way; and in dividing the stricture, which will generally be found at the external ring, the knife is carried directly upwards.

The formation of congenital scrotal hernia will readily be understood if it be remembered that the testicle is originally situated upon the psoas muscle, just below the kidney, and that, as it descends to the place which it is destined finally to occupy, it carries with it a process of the peritoneum, constituting what is called the vaginal tunic of this organ. In general, the portion of membrane lying in the inguinal canal is closed before birth, thereby cutting off all communication between the scrotum and the general abdominal cavity; but at times the reverse is the case, and then an opportunity is afforded for the protrusion of the abdominal viscera and the formation of the variety of hernia in question. Occasionally the testicle, as it descends towards the internal ring, becomes adherent to a coil of intestine which it thus carries along with it.

Congenital scrotal hernia is of frequent occurrence, and is capable, if



neglected, of acquiring a large bulk. In a case, recently under my observation, in a child only two years old, the tumor was fully as large as a foetal head, and extended two-thirds down the thigh. In general, however, it is quite small, and easily reducible; the testicle lies at the bottom of the tumor, and the vaginal tunic, which always forms the proper hernial sac, usually contains a small quantity of water. The external coverings of the tumor are the same as in scrotal hernia of the adult.

A reducible scrotal hernia requires the same management as an ordinary inguinal one; but it will be well not to begin the treatment with the truss, inasmuch as it is generally impossible for the little patient to bear the pressure of such an instrument without severe suffering. Instead of this, the parts should be supported with a compress and roller, or, what is better, with a gum-elastic girdle, provided with a broad, elastic pad. In this way an increase of the tumor may be pretty effectually prevented until the child has reached the age of eight, ten, or twelve months, when it will commonly be able to wear a truss, which may then advantageously replace the earlier and less perfect contrivance. Whatever apparatus be employed, great attention must be paid to cleanliness and to the prevention of undue irritation of the skin. If worn persistently, a radical cure may often be effected in a very short time, as the parts at that period of life always manifest a strong disposition to close after the descent of the testicle.

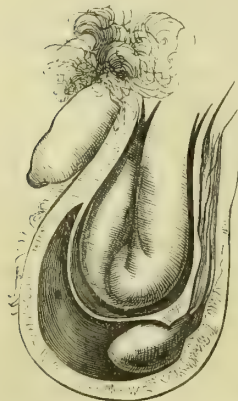
It is not often that a congenital scrotal hernia becomes irreducible, and it is still more rare to see it strangulated. Such an event, which has occasionally been witnessed within a few days after birth, is characterized by the ordinary phenomena, and may, in general, be promptly relieved by the taxis. Should this fail, the knife must be

used, but with the utmost caution, on account of the great thinness of the external coverings of the rupture, and the liability of peritonitis from the division of the vaginal tunic of the testicle, which, as before stated, forms here the proper hernial sac.

A very rare form of scrotal rupture is occasionally met with, generally described under the vague name of *infantile hernia* (fig. 389), and regarded as a subdivision of the congenital, although it has been found several times in adults who had been entirely free from all complaints of this kind in early life. Its peculiarity consists in having the vaginal tunic of the testicle in front of the proper hernial sac, so that, if a dissection be made of the parts, the protruded viscera will be seen to be invested by three distinct serous layers, besides the ordinary external coverings. In other and more explicit terms, the

communication between the vaginal tunic and the abdominal cavity is completely shut up, but the former membrane, instead of merely

Fig. 389.



Illustrating the state of the parts in infantile hernia.

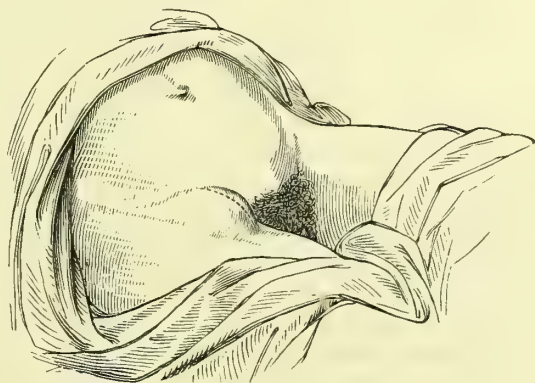
inclosing the testicle, as in the natural state, extends high up around the spermatic cord, forming thus a sort of pouch, behind which the viscera descend, in company with a prolongation of the peritoneum, which thus constitutes, as in ordinary cases of rupture, the proper hernial sac.

## FEMORAL HERNIA.

It would be well if the term crural could be altogether dispensed with in treating of hernia of the thigh, and the word femoral alone be used. It would certainly serve materially to simplify the subject, and to relieve it of much of the confusion which has hitherto attended its study. Under this conviction, I shall limit myself, in the remarks which I am about to offer upon this form of rupture, exclusively to the employment of the latter designation.

In femoral hernia, the abdominal viscera descend beneath Poupart's ligament, along what is called the femoral canal, the tumor, when fully developed, showing itself at the upper and inner surface of the thigh (fig. 390). In order to comprehend the precise relations of the pro-

Fig. 390.



Ordinary site and appearance of femoral hernia.

truded parts to the surrounding structures, it will be necessary to recall a few of the anatomical elements implicated in its formation. In the first place, then, it may be observed that the passages along which the bowel courses, bear a very strong resemblance to those which are concerned in the formation of an inguinal hernia by the oblique descent, consisting, like them, of a canal and two openings, one denominated the internal ring, and the other the external. To render the similitude more pointed, I shall designate the openings as the femoral rings, and the intervening track as the femoral canal; in the same manner as there are two inguinal rings and an inguinal canal (fig. 391).

The internal femoral ring is somewhat of a triangular figure, being

bounded anteriorly by Poupart's ligament, behind by the pubic bone, externally by the femoral vein, and on the inside by Gimbernat's ligament, or the third attachment of

Fig. 391.



Plan of femoral hernia. *a*. The sac. *b*. The femoral vein. *c*. The artery. *d*. The abdominal ring. *e*. Section of the psoas and iliac muscles. *f*. The acetabulum.

ment, or the third attachment of Poupart's. This opening is considerably larger in the female than in the male, and this is one, if not the principal, reason why this variety of rupture is so much more frequent in the former than in the latter. It is naturally closed by a lymphatic ganglion and a small quantity of cellulo-fatty matter, which thus generally offer not a little resistance to the descent of the abdominal viscera. The external femoral ring, usually called the saphenous opening, because it is here that the saphenous vein empties into the great femoral, is of an ovoidal shape, very spacious, and bounded by the crescentic edge which is formed here by the femoral aponeurosis. It is occupied by a number of lymphatic glands, as well

as by a large mass of dense, cellulo-adipose substance, forming what is termed the *cribriform fascia*, a structure playing an important part in the anatomy of femoral hernia. The canal between the two openings now described is very short, especially in front, its wall here being formed solely by the upper lunated border of the external ring, known as Hey's ligament. The posterior wall, on the contrary, is much longer, and is represented by the pubic portion of the femoral aponeurosis. Thus constituted, the passage is lined by a prolongation of the transverse fascia in front, and the iliac behind, and also by a thin layer of cellulo-adipose tissue, which, lying immediately beneath the former fascia, is continuous above with the cellulo-fatty matter which aids in filling up the internal ring, and below with the cribriform fascia. This substance, it may now be remarked, forms what is called the proper fascia of femoral hernia.

The abdominal viscera, passing down the thigh, through the openings here described, clothe themselves with a portion of peritoneum, which thus, as in the other varieties of the complaint, constitutes the proper hernial sac. If, therefore, a dissection be made of the coverings of the tumor, extending from without inwards, they will be found to present themselves in the following order: skin, superficial fascia, cribriform fascia, the funnel-shaped process of the transverse fascia, the proper fascia, and, lastly, the peritoneum. The position of the epigastric artery and the spermatic cord is deserving of particular notice in relation to this variety of rupture. The former always lies on the outside of the tumor, close to its neck, while the latter lies above and internally. The obturator artery, when given off by a



trunk common to it and the epigastric, as it is supposed to be in one case out of every four, arranges itself along the anterior and upper part of the tumor.

The contents of a femoral hernia usually consist exclusively of small intestine, generally a portion of the ileum, especially in cases of recent standing; but under opposite circumstances, and, in particular, when the tumor is bulky, both bowel and omentum frequently enter into its composition. Instances in which omentum alone protrudes are by no means uncommon; and I have a preparation, taken from an old lady of upwards of seventy, who had long labored under double femoral rupture, in which the contents are exclusively of this character. Examples are met with, although rarely, in which the tumor is composed of an ovary and Fallopian tube, of the uterus, or of the uterus, the Fallopian tube, ovary, and vagina. A case has been recorded in which the urinary bladder was the part protruded. Femoral hernia occasionally coexists with inguinal.

The tumor in femoral hernia is always small compared with that of inguinal hernia, seldom exceeding the size of an almond, and occasionally hardly attaining that of a nutmeg. Sometimes, however, its bulk is quite extraordinary, equalling that of a fist, or even that of a foetal head. In the latter case, the tumor is commonly of a globular shape, whereas, under ordinary circumstances, it is of an elongated ovoidal figure, longer in the transverse diameter than in the vertical. The hernia may be complete or incomplete, just as in the inguinal varieties of the complaint. In the former case, the viscera escape at the external ring, and form a tumor which lies on the upper and inner surface of the thigh, immediately below Poupart's ligament, and a little external to the spine of the pubes. In order to reach this point, the parts are obliged, upon reaching the external ring, to change their direction, passing upwards towards the groin instead of downwards towards the knee, and in doing this the two portions are doubled upon each other. The reason of this change of direction, a knowledge of which is so important in relation to the proper employment of the taxis, is the manner in which the saphenous vein enters the femoral, and the peculiar connection of the cellular tissue, at the lower margin of the external ring, with the femoral aponeurosis. The barrier thus formed, however, is sometimes broken down, and then the hernia not only descends along the thigh, but often acquires a large bulk in consequence of the restraint being thus taken off. In the incomplete form of the disorder, the tumor is always very small; and hence the true nature of the case is very liable to be overlooked, the intercepted portion of bowel occasionally not exceeding one-third, one-half, or two-thirds of the diameter of the tube. It is, in fact, a most dangerous form of hernia, similar, in every respect, to concealed, interstitial, or interparietal hernia of the groin, described in a previous page.

*Diagnosis.*—Femoral hernia is liable to be mistaken for other affections, from which it is of the greatest consequence that it should be distinguished. Of these the most important are inguinal hernia, psoas abscess, varix of the saphenous vein, and enlargement of the lymphatic glands.

In regard to the distinction between femoral and *inguinal hernia*, little difficulty can arise if it be borne in mind that, in the former, the neck of the tumor is below Poupart's ligament, while in the latter it is above. A good plan, therefore, in cases of doubt, is to trace the course of this ligament along its inner half with the finger, when, if it be found to be overlapped by the swelling, it may be assumed that the hernia is inguinal, it being well known that a femoral hernia rarely, if ever, ascends so high up. Besides, important information may be gained by a careful examination of the inguinal and femoral rings, the former of which, in particular, will always readily admit the tip of the finger when it is not occupied by the abdominal viscera. The size and shape of the tumor are not to be disregarded. In femoral hernia it is small and transversely elongated; in inguinal, on the contrary, it is comparatively large and of an irregular, hemispherical form. In the former, the tumor is fixed, and, when strangulated, soon becomes very tender; in the latter, it is movable, and does not suffer so early, nor are the constitutional symptoms usually so urgent.

*Psoas abscess* occasionally points beneath Poupart's ligament, forming a tumor, of variable size and shape, at the upper and inner part of the thigh, which may be mistaken for femoral hernia. The error will be most likely to occur when the swelling is small and recent; but even then a little care will generally suffice to establish the diagnosis. The best guides are the history of the case, the flexed condition of the thigh, with a certain degree of lameness, and the fact that the swelling always readily disappears under pressure during recumbency.

Varix of the *saphenous vein* at its entrance into the femoral, or of both vessels at this point, is sometimes met with, and several cases are known where it was treated as a femoral rupture. Such an error implies the most culpable carelessness, for it could certainly not be committed by any one who has the slightest tact or experience in examining patients. The diagnosis will always be easy when it is recollected that a varix is much softer than a femoral hernia; that it has a peculiar knotty feel; that it always co-exists with varicose enlargement of the saphenous vein below, and that, after having been effaced by manipulation, it speedily reappears under pressure applied to the femoral vein just above the external ring, when the patient stands up, no such effect following if the tumor be hernial.

The *lymphatic glands*, at the upper and inner part of the thigh, are liable to enlargement, both acute and chronic, and numerous cases have occurred of errors of diagnosis between this disease and femoral hernia, a rupture having been laid open for a supposed abscess, and an inflamed ganglion treated as a rupture. It is, perhaps, not always easy to discriminate between these two affections; but it is hardly possible to conceive of a case where a careful examination of the part, and a proper inquiry into the previous symptoms would not promptly dispel all doubt in relation to its real character. When symptoms of strangulation exist, along with a tumor of a suspicious nature, and one which does not promptly yield to antiphlogistic measures, the rule is to operate, both in this and in the other varieties of hernia. What complicates these cases occasionally, and embarrasses the diagnosis, is

the co-existence of glandular enlargement and femoral hernia, the latter of which is then apt to be very small, being concealed by the former.

*Treatment.*—Reducible femoral hernia must be treated with a well-adjusted truss, constructed upon the same principles as that used for inguinal hernia. It should rest over the hips midway between the crest of the ilium and the great trochanter, and should be provided with a small, slender block, very convex on the surface, and fastened to its spring nearly at a right angle. The object should be to concentrate the pressure as much as possible, which cannot be done when the pad is broad and flat, on account of the constant motion of the pectineal muscle. Care must be taken not to permit the block to exert any injurious compression upon the femoral vein, which, by embarrassing the return of the blood, might thus occasion serious mischief in the limb below, as anasarca, and even active inflammation. The precise spot where the pressure is to be made is just below Poupart's ligament, and a little external to the spine of the pubes, directly in the line of the femoral canal and the upper portion of the external ring, it being impossible, by any contrivance yet devised, to concentrate the pressure upon the internal ring. It is for this reason, in part, that a femoral hernia is so seldom radically relieved, the other causes of failure being found in the peculiar nature of the boundaries of the internal ring, these being partly osseous and partly ligamentous, and, therefore, in great measure insusceptible of adhesive action. A truss, then, in this variety of rupture, should be worn rather as a retentive apparatus than one designed to bring about a permanent cure. Owing to the circumstance, however, just alluded to, it is questionable whether a small portion of the hernia does not generally remain above the block of the instrument, within the mouth of the internal ring.

The *irreducible* hernia of the thigh is best supported by a truss with a hollow pad, so arranged as to receive and accommodate the protruded mass, and thus protect it from further increase, as well as from external injury. A piece of tin, silver, or gutta-percha, adapted to the shape of the tumor, well padded, and provided with a narrow margin, would answer a good purpose in such a case. The neck of the pad, or the part which intervenes between the pad and the spring of the truss, might be composed of some elastic substance, to enable these two portions to move upon each other in the various attitudes of the thigh and body. A proper support of this form of rupture is particularly important, since, if it be permitted to increase, it may acquire a large bulk, and thus greatly interfere with the patient's occupation, to say nothing of other inconvenience, and of the risk of strangulation.

For the relief of *strangulated* femoral hernia the taxis is employed; early, if possible, to obviate the necessity of an operation, and gently, in order that no harm may befall the compressed and entangled structures. It is of the greatest practical moment to remember that the symptoms here are always, other things being equal, much more urgent than in strangulated inguinal rupture, and that mortification occasionally takes place within less than twenty-four hours after the occurrence of the accident. Time, then, is a matter of immense consequence in



nearly all cases of this description. With a view of affording the taxis the best chance of success, particular attention should be paid to the attitude of the patient, the head, shoulders, and pelvis being thoroughly elevated, the legs flexed upon the thighs, and the thighs upon the pelvis, and both limbs, but especially the affected one, strongly rotated inwards. The object of the latter procedure is to relax, as completely as possible, the lunated margin of the external ring, which, particularly in the more perfectly developed forms of the affection, always exerts a very powerful constricting influence. For want of this precaution, the practitioner, unacquainted with the anatomy of this region, often signally fails in accomplishing his object, whereas, if he pursued a proper course, he would, perhaps, experience little, if any, difficulty. The effect which this structure exerts upon the reduction of the protruded parts, is well exemplified upon the dead subject, when the limb is alternately everted and inverted after a coil of intestine has been carried through the femoral canal and brought out at the external ring. It will then be seen that the former movement invariably pinches and compresses the bowel, while the latter relaxes it, and thus places it in a better condition for prompt and safe replacement.

The important rule now described being complied with, and the patient being brought under the influence of anæsthesia, the next step is to draw the tumor downwards and slightly inwards, to efface the elbow which it forms with the femoral canal, and to bring it opposite the external ring. The parts are now pushed directly backwards, so as to get them fairly out of the reach of the lunated edge of the ring, when, the pressure being next made in an upward direction, the reduction is, in general, easily accomplished. It is seldom that the bowel ascends with a gurgling noise, unless the protrusion is large, when the sound may be as distinct as in ordinary inguinal hernia.

The length of time during which the taxis should be persisted in, must, of course, be influenced by the circumstances of each particular case; but it may be stated, as a general rule, that it should be considerably less than in hernia of the groin; the efforts, too, should, if possible, be conducted with more gentleness, and no auxiliary measures, save anæsthesia and blood-letting, should be called into requisition in ordinary cases. If the symptoms are not urgent, or such as are denotive of inflammation of the part and peritoneum, trial may be made, after the first failure of the taxis, of anodynes and topical applications, either cold or warm, care being taken, in the meanwhile, to maintain the body and limbs in a position favorable to spontaneous reduction. If, after a certain period, the protruded parts do not return, or if, after a second effort, the taxis again fail, the symptoms gradually, but steadily advancing, no time should be lost in having recourse to the knife. To wait longer might, and probably would, endanger both the part and system.

An *operation* being determined upon, the patient is placed in the same position as in the operation for inguinal hernia, when an incision is made over the upper portion of the tumor, parallel with Poupart's ligament, and intersected by another carried down perpendicularly to-

wards its base; or, instead of this, a T-shaped incision is made; or, if the hernia be very diminutive, a single vertical cut may suffice. The skin and cellular tissue being thus divided, the greatest caution will be required in executing the remaining steps of the operation. Layer after layer is now elevated, and divided upon the grooved director, any lymphatic glands that may come in the way of the knife being pushed aside beyond the reach of harm. The cribriform fascia is often of considerable thickness, especially in corpulent subjects, and, along with the glands involved in its substance, forms a confused mass, difficult to unravel. This having been penetrated, the next structure that presents itself is the anterior layer of the sheath of the femoral vessels, below which, and in immediate contact with the hernial sac, is a thin stratum of cellular tissue, intermixed with a few granules of fat. Dividing this, if possible, with increased caution, the operator next searches for the seat of the stricture, which will usually be found at the lunated edge of the external ring, especially at its outer and upper part, at Gimbernat's ligament, or at Poupart's ligament. This examination may be made with the grooved director, or, what is preferable, with the finger, which is followed immediately with the probe-pointed bistoury, or hernia-knife, with which the resisting structure is slightly notched, the smallest incision being generally sufficient for the purpose. The protruded parts are next gently compressed with a view of unloading the bowel of its contents, and the omentum of its blood, after which they are carefully returned into the abdomen, the sac being left intact. But it may happen that the stricture is seated within the sac, particularly if the hernia be large and old, and, when this is the case, the sac must, of course, be laid open, its division being effected in the same manner as in inguinal hernia. Finally, it may be stated that in femoral hernia, consequent upon wounds, the external coverings are sometimes so extremely thin as to permit the peristaltic motions of the bowel to be seen.

In dividing the stricture in femoral hernia, it is of the greatest consequence to remember the relations which the tumor bears to the femoral vein, the epigastric and obturator arteries, and the spermatic cord, lest these important structures should be interfered with, and a copious, if not fatal, hemorrhage be the result. To accomplish this object, the safest rule is to carry the knife upwards with a very slight inclination inwards, and to keep it as much as possible behind Poupart's ligament. If the instrument were to be directed outwards the femoral vein might be punctured, as has happened in more than one instance; if inwards, the spermatic cord might be endangered; and if too far forwards, the obturator artery, should it lie in front of the tumor, as it does when it is given off by the epigastric, might be wounded. Seeing how closely the tumor is embraced by these important structures, the surgeon should be most cautious in his movements, taking care, above all things, to make as little use of the knife as possible in dividing the stricture. It would be well, indeed, if the edge of the instrument were quite blunt, and if the necessary division were effected with a kind of sawing motion, as such a procedure would afford the vessels in question a better opportunity of escaping injury. Should hemorrhage, however,

arise, despite the utmost precaution, it must at once be arrested by the ligature; or, when this is impracticable, on account of the inaccessible situation of the vessel, by means of pressure, either with the finger of a relay of assistants, or an appropriate compress and bandage, retained until all danger of bleeding is over.

The after-treatment is the same as in inguinal hernia; and similar precautions are necessary in regard to the use of the truss when the patient begins to walk about.

#### UMBILICAL HERNIA.

Umbilical hernia derives its name from the fact that the abdominal viscera are protruded at the umbilical ring, or what is vulgarly called the navel. The occurrence of this form of the complaint is not infrequent, and it presents some variety according as it shows itself in the foetus, in the infant, and the adult.

a. *In the Foetus*.—Umbilical hernia of the foetus is always dependent upon the defective development of the walls of the abdomen, and is frequently associated with malformation of other parts of the body, as hare-lip, bifid spine, club-foot, or extrophy of the bladder. Its contents usually consist of a coil of the small intestine, or of this portion of the bowel and of the colon, sometimes of the liver, occasionally of the spleen, and now and then, but very rarely, of the stomach. The affection has been noticed at a very early period of foetal existence, though it is most common during the latter stages of pregnancy. The tumor varies in volume, according to the extent of the deficiency in the parietes of the abdomen, from that of a thimble to that of a fist. It has a proper hernial sac, but no cutaneous covering, its external investment consisting of the transparent envelop of the umbilical cord, united to the peritoneum by a thin layer of cellular tissue. The umbilical vessels are sometimes separated by the protruded viscera; and the navel string is generally situated at the inferior margin of the tumor, or a little to one side of it.

When the umbilical tumor is large, death usually takes place within a few days after birth, from the effects apparently of peritoneal irritation. If the child survive, an attempt may be made to bring about a permanent cure by transfixing the edges of the umbilical ring with several delicate pins, and winding around each, in an elliptical form, a well-waxed ligature, as in the common hare-lip suture. In performing the operation care is taken not to interfere in the slightest degree with the peritoneum; the pins should be retained the better part of a week, and the abdomen should be well supported in the interval, as well as for some time after, by broad strips of adhesive plaster.

b. *In the Child*.—Umbilical hernia in the child generally comes on within the first two or three months after birth, and cases occur where it is congenital, or where it shows itself soon after the first severe paroxysm of crying. Whatever may be the period of its evolution, the immediate cause of the disease is a succession of violent muscular efforts, by which the abdominal viscera are forcibly impelled against the umbilical aperture, before it has had time to become completely oblite-



rated. The tumor, which rarely exceeds a common marble in bulk, is either hemispherical or conical, soft and gaseous in its consistence, and sensibly impressed by crying, laughing, coughing, or sneezing; retiring under pressure, and reappearing immediately when the pressure is removed. If, after the reduction has been effected, the finger be inserted into the opening, it will be found to be of a circular shape, with sharp and well-defined edges. The coverings of the tumor are the skin, cellular tissue, and peritoneum, its ordinary contents being small intestine; very rarely omentum, or omentum and intestine.

An umbilical hernia in the child must be treated by the same means, or, at all events, according to the same principles as a rupture of the same kind in the adult. If the disorder receive early attention, a radical cure may often be effected in a very short time, as there is always, at this period, a great tendency to contraction of the umbilical ring. Sometimes, indeed, the hernia disappears spontaneously, even after it has made considerable progress, especially when the general health is good, when there is not much obesity, and, above all, when care is taken to avoid the exciting causes of the complaint. Such a fortunate event, however, is very uncommon; hence the best plan always is not to wait for it, but to treat the case at once with a retentive apparatus, adapted to the age and comfort of the little sufferer. The contrivance from which most benefit is to be expected is a leather, wooden, ivory, or metallic pad, of a circular shape, perfectly flat, and large enough to overlap the edges of the ring, and confined by a broad strip of adhesive plaster, carried completely around the body. Over this, a broad gum-elastic band should be worn, in order to give due support to the whole abdomen. If the child has attained the age of two or three years, a proper truss should be worn, such as that used in this variety of hernia in the adult.

c. *In the Adult.*—In umbilical hernia in the adult the tumor is usually globular, or pyriform, and from not being larger originally than the end of the finger, it may, as it increases in age, acquire an enormous volume, extending, perhaps, as low down as the pubes. In corpulent persons it often manifests a disposition to insinuate itself beneath the skin, within the adipose matter, and the consequence is that it sometimes forms hardly any perceptible enlargement, as it does when the subject is emaciated. A hernia in such a state is peculiarly dangerous if it happen to become strangulated, from its liability to be overlooked, and, therefore, mismanaged. An instance of a fatal mistake of this kind occurred, some years ago, in the hands of a medical friend, a man of great intelligence, who never suspected the true nature of the disease until it was revealed by dissection after death. The patient was a married woman, whose abdomen was loaded with an enormous quantity of fat, beneath which a large, strangulated umbilical hernia existed.

An umbilical hernia in the adult generally contains omentum, or omentum and a portion of the colon; sometimes small intestine, but very rarely alone. Many years ago I dissected the body of a German woman, the mother of three children, in whom the hernia was composed exclusively of the gravid uterus, near the full period of gestation. The centre of the tumor bore distinct evidence of the remains

of the umbilicus. An instance of a double umbilical hernia occasionally occurs. The coverings of the tumor consist of the skin, superficial fascia, and peritoneum, the latter of which, especially in cases of long standing, is sometimes very thin, or thin at one point and thickened at another. The umbilical ring is generally towards the upper part of the tumor.

The most common cause of this form of rupture is laborious parturition, pregnancy, and habitual straining at stool. Females are much more subject to it than males, and fat persons than lean; it is rarely met with before the age of twenty-five or thirty, or until after the abdomen has become enlarged and pendulous from incessant distention of its walls. Constipation of the bowels, flatulence, colicky pains, nausea, and other evidence of digestive disorder are common attendants upon this variety of hernia.

The means best calculated for the retention of a small umbilical rupture in the adult is a truss with a wooden block, at least two inches in diameter, slightly convex upon its abdominal surface, and secured to an elastic spring, long enough to encircle the body. The ends of the spring should be fastened behind to a broad, oblong pad, six inches in length, and arched transversely, to adapt it the more accurately to the spine. When there is much obesity, or great volume of tumor, the block should be proportionably larger, and the operation of the instrument should be aided by a gum-elastic supporter, which, by taking off the weight of the abdominal viscera, will thus serve to diffuse and equalize their pressure against the abdominal parietes. No truss that does not combine these qualities can be considered, under such circumstances, as of much value; for, although a radical cure can seldom be effected in any case, yet there is hardly one, however large, inconvenient or painful, that cannot be materially relieved by these means. As to the blocks and pads with a central prominence, until lately so much used in this country, it would be difficult to conceive how they could produce any other than an injurious effect, as their action must inevitably be to separate still farther the edges of the umbilical ring into which the knob projects.

One of the peculiarities of the umbilical hernia in the adult is that, if neglected or mismanaged, it soon becomes *irreducible*, either from the enlargement of its contents, or from their adhesion to each other and to the inner surface of the sac. Hence, every possible endeavor should be used to prevent this occurrence, or, if this be impracticable, to restrict it within the smallest possible limits by suitable antiphlogistic and retentive means. The existence of tenderness and pain in the tumor, constipation of the bowels, nausea, and general uneasiness in the abdomen, should be attentively watched, and regarded with suspicion. Should the symptoms increase instead of diminishing, blood should be abstracted by the lancet and by leeches, the rectum stimulated by injections, and the belly well fomented with water and laudanum. To aid in the removal of plastic matter, small doses of mercury may be used for some time after, and sorbefacients applied to the tumor. If, notwithstanding these precautions, the hernia remains irreducible, or if it was so before the surgeon was consulted, timely

measures must be employed for the prevention of its further increase, as well as for its protection against external injury. The most efficient and convenient apparatus for this purpose is a hollow truss, cup-shaped, well padded, and retained in place by a scapulary, or the addition of a gum-elastic supporter. To obviate griping, flatulence, and dyspepsia, a concentrated and easily digestible diet and a soluble state of the bowels should be enjoined.

If *strangulation* ensue, no time should be lost in employing the taxis, the patient being anesthetized, and placed in the same posture pretty much as under similar circumstances in the other varieties of hernia. If the tumor is at all bulky, its contents, after having been drawn away from the umbilical ring, must be pressed directly upwards, or upwards and backwards, in a direction opposite to that of the displacement, it being remembered that in all cases of this kind the tendency of the protruded parts is to descend towards the pubes. Should the taxis fail, and the symptoms not be urgent, the effects of a full anodyne, and of cold or warm applications may be tried, and often with a prospect of success. When we consider how disastrous have been most of the operations that have hitherto been performed for the relief of strangulated umbilical hernia, we can scarcely lay too much stress upon the protracted and judicious employment of the taxis. There is a period, of course, when we must desist, or when further efforts of the kind would be improper, but it is not always easy to specify it, and hence much must be left, in every case, to the judgment of the practitioner.

In performing the *operation*, an inverted **I**-shaped incision will generally be proper, the vertical limb being carried nearly an inch above the upper extremity of the tumor, directly in the course of the *linea alba*. Bearing in mind the thinness of the external coverings, particularly in recent cases, the knife is passed, upon a grooved director, successively through the skin and cellulo-fatty matter, down to the hernial sac, which is, if possible, left intact, experience having shown that its division is fraught with the greatest danger from its liability to be followed by fatal peritonitis. Seeking now for the seat of the stricture, which will usually be found to be at the upper margin of the ring, the knife is conducted upwards upon the finger, and the resisting structure divided to the requisite extent. The protruded parts being drawn somewhat downwards, to liberate them from their confinement, are next gently replaced into the abdomen, first bowel and then omentum, in the usual manner. Should the constriction, however, be ascertained to be within the sac, then the sac must be opened, care being taken, for the reason already mentioned, to make the incision as small as possible. When the hernia is irreducible, the protruded structures are left, after the division of the stricture, in their extra-abdominal situation.

#### VENTRAL HERNIA.

Hernia may occur at other points than those where the natural openings of the abdomen exist, the names by which it is designated



having reference to the particular situation of the protruded viscera, as ventral, obturator, and ischiatic.

a. *Ventral* hernia is so called from the fact that it involves the parietes of the belly, which are rendered defective in consequence of a wound, or the accidental separation of some of the muscular and tendinous fibres. It may occur in any part of the walls of the abdomen, but is most common in the middle line, above the umbilicus and in the inferior half of the semilunar line. The tumor, though generally diminutive, is capable of acquiring a large bulk, and has seldom more than three coverings, namely, the skin, superficial fascia, and proper sac. The symptoms and treatment involve nothing peculiar; nor does the operation when strangulation takes place, except that special care should be taken not to injure the epigastric artery, as might happen if the stricture were divided in any other direction than the perpendicular. The sac ought also generally to be left intact for fear of violent peritonitis.

b. In *obturator* hernia the viscera follow the course of the obturator vessels, forming a tumor at the upper and inner part of the thigh; under cover of the pectineal and adductor muscles, generally so small as not to be cognizable by the finger, much less by the sight. It usually consists of a portion of small bowel; is supposed to be more common in females than in males; and, owing to its deep situation, is rarely detected during life. A few cases of double obturator hernia have been observed. In the event of its becoming strangulated, reduction might possibly be effected by thoroughly relaxing the muscles of the thigh, and pushing the finger directly upwards in the course of the obturator foramen. If the taxis should fail, an operation might be required, but it would be difficult of execution, and not without danger on account of the close proximity of the femoral vessels to the line of incision. A modification of the ordinary femoral truss might answer for the retention of such a hernia when it forms a distinct external tumor.

c. The *ischiatic* hernia, which protrudes at the ischiatic notch, is extremely rare, and has probably never been recognized in the living subject. In the few cases in which it has been dissected after death, it has been found to contain small intestine; in one instance the ovary was protruded.

d. *Perineal* hernia descends by the side of the rectum and anus, or immediately in front of these tubes, its contents generally consisting either of the small intestine or of the urinary bladder. The protruded parts do not always appear externally in the perineal region, but occasionally they form a tumor of the volume of a pullet's egg. In a case which came under my observation, some years ago, in a middle aged lady, the mother of six children, the tumor, which lay between the vagina and rectum, and was of a very soft consistence, was about the size of an ordinary marble, and easily reducible by the slightest pressure. The most remarkable feature about it was its transparency, which was so great that the bowel could almost be seen through it. It had existed for many years, but had not been productive of any physical inconvenience.

e. *Labial* hernia is a very rare form of this complaint, in which the parts descend between the vagina and the branch of the ischium. The tumor, which is soft and elastic, varies in size from a small marble to a pullet's egg, readily recedes under pressure, and is usually situated in the inferior half of the great lip, beneath the mucous membrane. It is nearly always composed of a portion of bladder, the cases in which it contains intestine being extremely rare. In a woman examined by Mr. A. Burns, a hernia, occupied by the bladder, existed in each labium. The affection is distinguished from inguinal hernia by the natural state of the external ring, and by the fact that the tumor can be traced with the finger into the pelvic cavity. When the rupture becomes troublesome, it may be restrained by a pessary, or a gum-elastic bandage, the constant use of which has occasionally produced a radical cure. Strangulation is, in general, easily relieved by steady and persistent pressure; this failing, the sac is exposed, and the stricture divided in the direction of the vagina.

f. *Vaginal* hernia is merely a variety of the labial; it presents itself under two varieties of form, the anterior and posterior, the first usually containing bladder, and the other intestine. It varies in size in different cases, being sometimes not larger than a thimble, while, at other times, it is so voluminous as to block up the whole vagina; it is of an irregular, globular shape, elastic, free from pain, influenced by coughing, and easily reduced by pressure. The treatment consists of rest in the recumbent posture, astringent injections, a hollow pessary, and an abdominal supporter, aided, when the tumor is cystic, by the occasional use of the catheter.

g. Occasionally the abdominal viscera project into the chest, thereby constituting *diaphragmatic hernia*. The left side is more frequently involved than the right, and the protruding parts usually consist of the stomach, colon, omentum, or small intestine, the order of frequency being as here stated. The liver, spleen, and even the pancreas sometimes enter into the hernia. The affection may be produced by external violence, as a fall, blow, or wound, or by severe straining in vomiting; but, in the majority of instances, it is the result of congenital malconstruction, attended with a separation of the muscular or tendinous fibres of the diaphragm. In the only two cases of the accident that have come under my observation, the cause, in one, was a stab in the side, through the sixth intercostal space, and, in the other, a fall from the third-story window of a house upon the brick pavement below. The wound, in both the cases, was on the left side, and was large enough to admit nearly the whole of the stomach into the thoracic cavity. One of the persons died in a few hours, the other on the second day. Occasionally the protrusion takes place through a pouch by the side of the œsophagus, the aorta, or the vena cava. A proper hernial sac exists only when the accident is caused by a gradual separation of the fibres of the diaphragm; in the congenital form, the peritoneum and pleura are directly continuous with each other; and in that following upon wounds and lacerations, the serous membrane is always divided along with the other structures of this musculo-aponeurotic septum. Congenital diaphragmatic hernia may co-exist

with bifid spine, hare-lip, or club-foot, and proves fatal in nearly half the cases that occur at the moment of birth; a few cases survive several months, or a few years, and now and then a person attains to adult age. In diaphragmatic hernia from accident, death may take place instantly, or not for several days, weeks, months, or even years, though the latter event is extremely rare. The diagnosis of the disease is uncertain, and hence little is to be expected from treatment. Much valuable information respecting this form of hernia will be found in a learned paper upon the subject by Dr. H. I. Bowditch, of Boston, in the Buffalo Medical and Surgical Journal for 1853.

### SECT. III.—INTERNAL STRANGULATION OF THE BOWEL.

Internal strangulation of the intestines may take place in different ways, and under a great variety of circumstances. A knowledge of this fact suggests the propriety of arranging it under the following heads: 1. Strangulation from the development of a membranous band, from the attachment of one portion of the bowel to another or to an adjoining organ, or from unnatural adhesions of the free extremity of the vermiform appendage, omentum, or Fallopian tube. 2. From the rotation of the canal on its own axis, or round an axis formed by the mesentery. 3. From one portion of the bowel compressing another. 4. From the intestine slipping into an abnormal aperture in the omentum, mesentery, or mesocolon. 5. From the pressure exerted on the canal by a tumor, an enlarged ovary, or a diseased uterus. 6. From one piece of bowel falling within another, constituting what is called intussusception. This classification comprises all the forms of internal strangulation of which I have any knowledge.

However induced, the *symptoms* are similar to those which characterize strangulation in hernia, and need not, therefore, detain us here. The diagnosis is generally exceedingly embarrassing, and often entirely impracticable, both as it respects its character and situation. The most reliable circumstances are the absence of everything like a tumor in the abdominal and pelvic regions, whether at the usual site of hernia or anywhere else, and the excessive obstinacy of the constipation and gastric distress. But these symptoms, prominent as they usually are, are altogether unreliable as signs of the disease, inasmuch as they are precisely like those which occur in incomplete inguinal and femoral rupture, unattended by external swelling.

Owing to the fact just mentioned, internal strangulation is generally a fatal disease, its very obscurity forbidding interference. But even when the surgeon is bold enough to undertake an operation, it is extremely rare that he succeeds in affording relief, either because the procedure is attempted as a dernier resort, or because it excites fatal peritonitis. In two cases of the kind, where, after mature consultation with eminent physicians, interference was deemed proper, I signally failed to confer any benefit, one patient dying at the end of four hours, and the other in less than thirty-six hours.



## SECT. IV.—ARTIFICIAL ANUS.

Artificial anus is usually the result of gangrene of the bowel from the pressure exerted upon it by the stricture in strangulated hernia. It may also follow upon a wound of the bowel, and upon stercoraceous abscess. However produced, it is most frequently met with in the inguinal, scrotal, and femoral regions, in connection with the small intestine. When caused by mortification, the two ends of the bowel lie in immediate contact with each other, in the bottom of the hernial sac, like the tubes of a double-barrel gun, their junction being formed by their contiguous walls, each, of course, consisting of four layers. During the inflammation which precedes the sloughing process, the outer or serous surfaces become firmly adherent, not only to each other, but also to the edges of the opening in the abdomen; hence, when the bowel gives way, there is no danger of fecal extravasation into the peritoneal cavity. The junction of the two cylinders here referred to, forms a kind of angular, spur-like process, ridge, or buttress, which opposes an effectual obstacle to the passage of the contents of the upper portion of the bowel into the lower, which, in consequence, soon becomes empty and collapsed. As the patient has no control over his feces, they have an incessant tendency to escape, thus not only irritating and annoying him, but, what is worse, rendering him an object of disgust alike to himself and to all around. Moreover, he generally suffers from prolapse of the mucous membrane of the gut, sometimes of one, at other times of both ends, especially the upper; and, if the opening happen to be situated high up in the canal, there is danger that his general health may become seriously affected from the want of proper nourishment, in consequence of the premature escape of the ingesta. Flatulence, pain, and indigestion are also common attendants upon artificial anus. It is proper to add that the ridge between the two cylinders is usually much less distinct when the accident supervenes upon a wound of the bowel, or a stercoraceous abscess, than when it is caused by mortification.

The opening in the wall of the abdomen, in which the ends of the bowel lie, is of variable diameter, shape, and depth, and is encircled by thick, irregular edges, generally more or less everted, or everted at one point and inverted at another. The surface immediately around, from the constant contact of fecal matter, bile, and mucus, is usually red, inflamed, chapped, or ulcerated, and so tender as to cause considerable suffering. At the bottom of the opening the two extremities of the bowel are closely embraced by a kind of membranous pouch, technically termed the *infundibulum* or funnel, of a firm, dense structure, from one to two lines in thickness, and formed by a prolongation of the proper hernial sac.

The *treatment* of artificial anus naturally divides itself into palliative and radical. The first consists in promoting the comfort of the patient, by strict attention to cleanliness, preventing the too early escape of the ingesta, and combating such accidents or complications as are liable to arise during the progress of the disease. The radical treat-

ment is, of course, designed to re-establish the natural route of the feces, and to obliterate the opening in the wall of the abdomen. The first of these objects is accomplished by attention to cleanliness, and the use of a well-adjusted truss, furnished with a broad pad to maintain equal pressure upon the parts, which, if the spur-like process between the two cylinders is not too large or prominent, is often of itself sufficient to effect a cure. When the case is irremediable, or unusually troublesome, a receptacle, made of gutta-percha lined with silver, must be worn, the vessel being frequently emptied and cleaned.

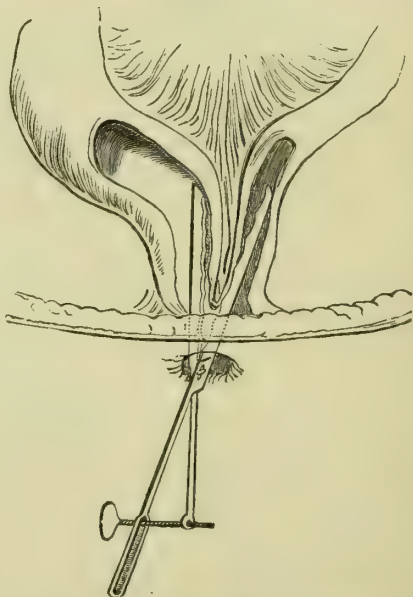
The radical cure may be attempted in one of two ways; either by means of the seton, as originally suggested by Physick and Schmal-kaiken, or with the enterotome, as practised by Dupuytren. The object of both is to destroy the spur-like process between the two intestinal cylinders, so as to re-establish the natural route of the feces; which, when accomplished, is soon followed by the closure and cicatrization of the abnormal opening. The seton, which is best adapted to the milder forms of the affection, may consist of a piece of narrow braid, or a stout gum-elastic thread, introduced with a short, curved needle mounted upon a handle. It should be carried to a considerable height, through one tube and out at the other, and be retained for several weeks, or until there is reason to believe that it has produced firm union between the two cylinders, when all that portion of the septum lying below the foreign body is cast away.

The enterotome, as seen in the annexed drawing (fig. 392), consists

Fig. 392.



Fig. 393.

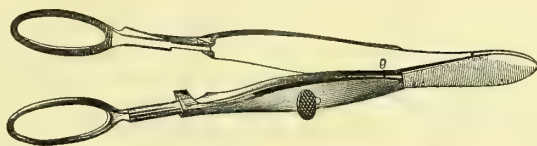


of two serrated blades, a male and a female, about six inches in length, united by a movable pivot, and brought together by a screw passed through the ends of the handles. Figure 393 exhibits the

application of the instrument to the spur-like process formed by the junction of the two cylinders, one blade being inserted into the upper and the other into the lower cylinder. Great care must be taken that the pressure in the first instance is not made too firm, otherwise very serious suffering, if not death, may arise. The proper plan is to tighten it gradually from day to day, until it has cut its way effectually through the septum. If, notwithstanding this, the patient experience much pain, free use should be made of anodynes, a careful watch being kept all the while upon the peritoneum. Moreover, it will always be well before commencing such an operation, to subject the patient to a certain degree of preparatory treatment, in order that he may be the better able to bear up under its effects. The instrument may usually be taken off in from six to eight days.

The adjoining cut (fig. 394) exhibits an enterotome which I devised many years ago, while treating a case of artificial anus consequent

Fig. 394.



upon a wound of the small bowel. It fulfilled the indication most admirably. It is much lighter and smaller than that of Dupuytren, while the pressure which it is capable of exerting is very great. It consists of two blades, brought together by a strong slide, and terminating each in a ring deeply notched on the inner surface.

From a statement published by Dupuytren, it appears that from the time he first employed his instrument, until 1824, twenty-one operations had been performed with it by himself, and twenty by other practitioners. Three-fourths of the cases had been caused by gangrene from strangulated hernia, and the remainder by penetrating wounds, attended with more or less loss of substance of the tube. Of the whole number thus treated, only three died; one from fecal effusion, one from indigestion, and one from peritonitis. Of the thirty-eight that survived, none experienced any ill effects, except a few who had colicky pains, nausea, and vomiting, which were promptly relieved by effervescent draughts, leeches to the anus, and fomentations to the belly. The success was not equally great in all the cases. Twenty-nine were radically cured in from two to six months, but the rest retained, in spite of all that could be done, fistulous openings, which compelled them constantly to wear a compress and bandage, to prevent the escape of air, mucus, bile, and even feces.

Artificial anus, caused by wound of the bowel, is always extremely difficult to cure, owing to the small size, or entire absence of an intervening spur, admitting of the application of the seton or enterotome. In a case of this kind which was under my charge some years ago, I was strongly tempted to liberate the bowel from its attachments, and



either to sew up the opening, or to excise a small portion, prior to restoring it to the abdomen. I was only deterred from carrying out the idea from the patient's indisposition to submit to the operation.

Finally, when, after the feces have resumed their natural route, the external opening refuses to heal, an attempt may be made to effect its closure by a dermo-plastic operation, the flap being borrowed from the neighboring parts. In general, however, the effort will prove abortive, owing to the difficulty of preserving the flap from the contact of intestinal matter.

## CHAPTER XIII.

DISEASES, INJURIES, AND MALFORMATIONS OF THE  
ANUS AND RECTUM.

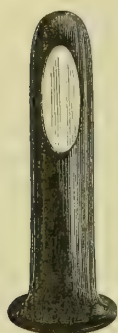
THE affections of the anus and lower bowel are of deep surgical interest, inasmuch as they are not only of frequent occurrence, but a source of much suffering to the patient and of great perplexity to the practitioner. In entering upon their discussion, it may be remarked, by way of introduction, that most, if not all, of the idiopathic diseases of this portion of the body are induced, maintained, or aggravated by disorder of the digestive, urinary, and genital apparatus, and that it becomes, therefore, a matter of primary importance, as it respects the issue of our treatment, to inquire not only into the nature of their exciting causes, but also, in a special manner, into the condition of the associated organs. No progress can be made in any case without a due consideration of this kind, and without proper attention to the secretions, the bowels, and the diet. Frequent ablutions with water, or, what is better, water and soap, are most valuable auxiliaries, and cooling enemata, either simple or medicated, often remarkably expedite the cure, or, where the disease is irremediable, greatly promote the comfort of the sufferer. When the pain and inflammation are severe, the recumbent posture must be rigidly enjoined, as tending to prevent determination of blood and allay nervous excitement. The diet, as a general rule, should be plain, simple, and unirritant; all stimulants, both in the form of food and drink, must be carefully avoided, and the mind should be kept in as tranquil a condition as possible. The effect of mental influence upon the progress and termination of diseases of the anus and rectum has not, I am confident, received sufficient consideration from practitioners. My experience is that any disturbance of the kind is always highly prejudicial, and I, therefore, make it a rule to guard against it by every means in my power.

## EXAMINATION OF THE ANUS AND RECTUM.

The diagnosis of the diseases of the anus and rectum is determined by the speculum, finger, and bougie. Before any examination, however, is attempted, the lower bowel is thoroughly emptied either by a dose of castor-oil, or by a stimulating enema, otherwise embarrassment, if not positive failure, will be sure to be the consequence. This object being accomplished, the patient is placed upon his back across the bed, with the buttocks slightly elevated, and projecting a little beyond the edge of the mattress. The feet may rest upon a high chair, or the

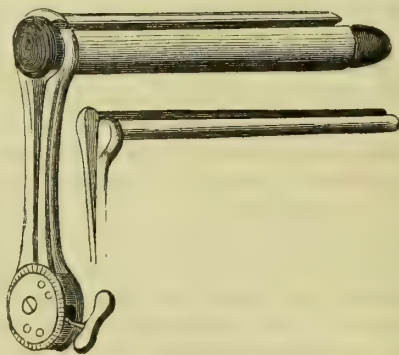
knees may be widely separated, and raised towards the chin, so as to expose the perineum. Or the patient may lie upon his side, the limbs being strongly flexed upon the pelvis; or, as I usually prefer, he may rest upon his knees and forearms, the head being depressed, and the nates elevated. Whatever posture be adopted, a strong light is necessary to a satisfactory result. The speculum, warmed and well oiled, is then inserted into the anus, gently passed up the rectum, and rotated until the whole of the mucous surface has been fairly brought into view. If the view be obstructed by mucus, blood, or feces, clearance is effected with a sponge mop. The best instrument for such an examination is the one represented in fig. 395. The valvular speculum (fig. 396), so much vaunted by some, is a very inferior contrivance

Fig. 395.



Fenestrated speculum.

Fig. 396.



Valvular speculum.

for such an exploration, as it permits the too easy insinuation of the mucous membrane between the blades, thereby preventing accurate inspection. A wire speculum has lately been recommended, but this also is inferior to the fenestrated one, here delineated. Important information may often be derived from the employment of the finger, carried about in different directions in the interior of the gut; and in stricture, or obstruction from foreign bodies, the diagnosis can hardly be established without the aid of a rectum-bougie. In most cases, a delicate probe should be at hand, especially if there be reason to suspect the existence of a fistule, which cannot be properly explored in any other manner.

The administration of *injections* is seldom performed with the care and attention which its importance demands. It is an operation which any one is supposed to be capable of executing, and the consequence is that it is generally done in a very awkward and bungling manner, without at all attaining the object for which it is undertaken. Simple as, apparently, it is, it requires an amount of skill which few of those who are intrusted with its performance possess. To answer the purpose for which it is intended, the enema should, in the first place, be accurately adapted, by its quantity and quality, to the capacity and



tolerance of the bowel; and, in the second place, it should be administered in such a manner as not to pain, irritate, or injure the parts. The best instrument, according to my observation, for the purpose, is a gum-elastic syringe, of the requisite size, with a long, slender nozzle, which should be well oiled, to facilitate its introduction, and carried a considerable distance up the tube, the patient lying upon his side at the edge of the bed, with the thighs somewhat bent upon the abdomen. If the patient be very restive, or unmanageable, as he may be if he is a child, or affected with delirium, he should be carefully held during the operation, otherwise the bowel may be severely wounded, or even perforated, as in the interesting case recorded by Professor Pope, of St. Louis, where a child, a few years old, lost his life from this cause. Whatever may be the object of the enema, whether purgative, stimulant, astringent, or anodyne, no air is to be introduced with it, as this is always productive of pain, and frequently completely frustrates the design of the operation. When it is desired to retain the injection for some time, and the bowel is exquisitely irritable, manifesting a constant inclination to throw off its contents, the end may sometimes be attained by the pressure of a warm cloth against the fundament. When the patient finds it necessary to employ injections habitually, a self-injecting instrument, capable of holding a pint, and furnished with a long, curved nozzle, answers an excellent purpose, and may be used by the patient in the recumbent or semi-erect posture, as he may prefer. A stomach-pump, worked by a suction apparatus, is required when there is excessive torpor of the bowels, with pain and inability to effect an evacuation. The tube, well oiled, is carefully inserted into the rectum, and thence carried up as high as possible into the colon. An abundance of water is then thrown in to soften the fecal matter and excite the peristaltic action of the bowel. It is not always that the operation succeeds, owing to the tortuous, compressed, and displaced condition of the sigmoid flexure of the colon.

Patients affected with inflammation, neuralgia, spasm, or organic disease of the lower bowel, are often immensely benefited by the use of anodyne *suppositories*. To produce their proper effect, it is necessary that they should be of a tolerably firm consistence, conical in their shape, and inserted as high up into the tube as possible. They should, moreover, be quite smooth, free from all irritating ingredients, and well oiled previously to their introduction, which is best effected with the index-finger, also well anointed. If the bowel be distended with fecal matter, a stimulating injection precedes their use.

#### INJURIES OF THE RECTUM.

The rectum and anus are sometimes severely lacerated, either by accident or design; the great danger in such an injury being hemorrhage and inflammation, occasionally extending to the peritoneum. The wound is usually caused by a fall from a considerable height, in which the buttock strikes the post of a chair, a stick, or the bough of a tree. I recollect meeting with a case, many years ago, where these

parts were severely lacerated by the horn of an infuriated cow; and in 1852 I attended a young man with Dr. Knight, of Louisville, whose rectum was so badly torn by the post of a chair that he came very near dying from cystitis and peritonitis.

The hemorrhage consequent upon wounds of the ano-rectal region is sometimes very abundant, amounting to many ounces, and, unless promptly arrested, leading ultimately to great exhaustion. It generally proceeds from one of the hemorrhoidal arteries, but occasionally it is almost entirely venous in its character. The blood usually flows into the bowel, from which, however, it is soon expelled, either in a semi-fluid or coagulated state; and thus the case progresses, portion after portion coming away, until, perhaps, syncope opposes a temporary barrier to its further effusion. It is astonishing with what pertinacity the bleeding sometimes continues in these cases, even when, apparently, none of the larger vessels are implicated.

Another source of danger in wounds of this region is peritonitis, particularly when the lesion extends high up, or when, as occasionally happens, the weapon penetrates the recto-vesical pouch of the serous membrane of the abdomen. The symptoms denotive of this occurrence need not be described here, but it may be stated that the practitioner should be on the constant look-out for them that he may lose no time in combating them if they should arise. Unusual tenderness of the abdomen, with a small, quick, hard, and wiry pulse, should always excite suspicion, and induce him to redouble his vigilance. Occasionally, as in one of the cases above alluded to, the bladder is seriously implicated, and then we may have both cystitis and peritonitis along with inflammation of the anus and rectum.

The *treatment* of wounds of the anus and rectum must be conducted according to the general principles of surgery. Hemorrhage is checked with the ligature, or, this being impracticable, by styptics, as strong enemata of alum, tincture of the chloride of iron, or turpentine, aided by exposure of the buttocks, and the application of ice; elevation of the parts, and a full opiate, not being omitted. If the ordinary means fail, plugging is had recourse to. If the wound is within reach, its edges are approximated by suture; and the bowels are kept quiescent by the usual means, the passage of fecal matter being always prejudicial. Antiphlogistics receive due attention; first, as prophylactics, and, secondly, as combatants of the inflammatory process, especially when it manifests a tendency to invade the peritoneum and bladder.

#### HEMORRHAGE OF THE RECTUM.

Hemorrhage of the anus and rectum may occur spontaneously, as an accompaniment of hemorrhoids, or as a consequence of ulceration, accident, or surgical operations. It may be small and insignificant, or so copious as to induce syncope and even death. The blood may accumulate by regurgitation in the colon and upper extremity of the rectum, or it may cause tenesmus, and be discharged by stool. In its character it may be arterial, or almost purely venous, large quantities

of blood being sometimes lost from a wounded hemorrhoidal vein, especially when it has been long in a state of disease.

The *treatment* varies. If the bleeding proceed from numerous points, astringent enemas, the insufflation of powdered alum and tannin, ice to the anus and perineum, opium and acetate of lead, cooling drinks, and perfect quietude, with elevation of the buttocks and their exposure to the air, may suffice to arrest it. When a considerable-sized artery has been divided, as indicated by the scarlet color and peculiar jet of the blood, the vessel is sought, and secured with the ligature. If the artery is situated high up, it may be necessary, before this can be done, to draw down the bowel gently with the tenaculum inserted into the submucous cellular tissue, or the patient may attempt to force it down by straining as he sits upon the chamber. If ligation is impracticable, the actual cautery must be used, the parts being protected with the speculum; or digital pressure is maintained by a relay of assistants; or, finally, recourse is had to the tampon, secured by a compress and a T-bandage. The most suitable contrivance of this kind is a cylinder of gum-elastic, a hog's bladder, or a piece of oiled silk, provided with a stopcock, so as to admit of inflation or injection.

The colpeurynter, an instrument now much used by obstetricians in certain forms of uterine hemorrhage, might be advantageously resorted to in bleeding of the bowel, proceeding from numerous small vessels. It simply consists of a bag of vulcanized India-rubber, which is introduced into the rectum, and then distended with air, or cold water, the object being to make uniform pressure upon the affected surface.

#### FOREIGN BODIES IN THE RECTUM.

Foreign bodies occasionally lodge in the rectum, causing more or less pain, inflammation, abscess, and other mischief. They may descend through the stomach, and be arrested by the sphincter muscle; or they may form in the canal itself, constituting what are called intestinal concretions; or they may be introduced through the anus, either with a view of relieving constipation, or with malicious intent. In the first case, which is by far the most common, the substances most generally consist of fragments of bone, pins, needles, coins, apple-cores, and pieces of meat, gristle, or tendon. Sometimes the rectum becomes distended with cherry-stones, or with undigested food, as peas, beans, and currants, which, swallowed almost in a dry state, and with hardly any mastication, escape the chymifying action of the stomach, but become swollen by the absorption of moisture in their transit through the intestinal tube, in the lower extremity of which they finally lodge, to the detriment both of the part and the neighboring organs.

Intestinal *concretions*, properly so-called, are uncommon in this country, if, indeed, not everywhere. The inhabitants of Scotland, owing to the peculiarity of their diet, are, perhaps, more frequently affected with them than any other people. They vary very much in their size and shape, as well as in the symptoms accompanying their development. When they descend into the rectum, they may cause



serious obstruction, interfering with the evacuation of the bowels and bladder, and even with the passage of the child's head in parturition.

The foreign substance sometimes enters by the anus. Patients, in their desire to relieve themselves of stricture, hemorrhoids, or prolapse of the bowel, have been known to allow, through inadvertence, the instruments which they employed for their cure to slip out of their fingers up into the rectum. Such accidents are probably more frequent than is generally imagined, since they are often very much favored by the suction-power of the tube. Bougies, vials, bottles, and various other articles have thus occasionally found their way into the rectum. Pebbles, slate-pencils, and pieces of wood, are among the substances sometimes introduced into the lower bowel by children and hysterical females.

Foreign substances are sometimes inserted into the rectum by design, either with a view of destroying life, or for the purposes of revenge. The science of medical jurisprudence supplies numerous examples of the former; and of the latter, a memorable instance has been recorded by Marchetti, in which the but-end of a pig's tail, rendered rough by cutting off its bristles, was forced up the rectum of a courtesan, by some mischievous students in the University of Göttingen.

The gut is occasionally obstructed by hardened *feces*. Old, infirm subjects are most prone to such accumulations, but they also occur in younger persons, especially in those who have become partially paralyzed, and who are, in consequence, unable to empty their bowels with their accustomed regularity. The quantity of fecal matter varies much in different cases. I have known it to be so large as to distend the tube apparently to its very utmost, completely paralyzing the gut, and causing excessive suffering. An instance of this kind, dependent upon great torpor of the bowels, and complicated with anal fistule, fell under my observation a few years ago, in a medical gentleman, aged thirty-five. Excessive prostration existed, on account of the patient's inability to take food, as well as the depressing effects of his disease, and he had suffered immensely, for several days, from pain and spasm of the anus and rectum, before I became apprised of the true nature of his situation. Prompt relief was afforded by the removal of a large quantity of hardened feces. In another case, that of a married female, an enormous collection of indurated feces existed in the lower bowel, which had not been evacuated for a month, although the desire to do so was almost incessant.

Finally, the rectum may be the seat of great discomfort from the presence of *ascarides*. Children, from the age of three to ten years, are most liable to suffer in this way, but grown persons are not exempt. The worms often occur in immense numbers, causing the most terrible itching in the part, as well as much general distress. They are usually surrounded by tough, tenacious mucus, and lodged immediately above the verge of the anus, in the rectal pouches. At times, they leave their hiding place, and appear externally, thus at once removing all doubt respecting the real nature of the case.

The direct effect of a foreign body in the rectum is inflammation of

its lining membrane, with an increased secretion of mucus, pain and tenderness, a sense of weight, and a frequent desire to go to stool. If the substance be large, it will necessarily act obstructingly to the evacuation of the feces, and may, if long retained, lead to serious disorder of the general health, accompanied with great derangement of the bladder, and, perhaps, also of the genital organs. In severe cases there is nearly always partial prolapse of the bowel, with violent spasm of the sphincter muscles, and a discharge of bloody mucus, or even of purulent matter. The patient is sallow, dyspeptic, emaciated, and dejected.

In the *extraction* of foreign substances from the rectum, the surgeon is governed by the circumstances of each individual case. In general, when they are not situated too high up, they may readily be removed by the finger, or with a pair of forceps, the anus being previously dilated with the finger or speculum. Large alvine concretions may require to be crushed before they can be withdrawn, but such an expedient can rarely be required, much less the division of the sphincter muscles. Should the latter, however, become necessary, on account of the extraordinary bulk of the foreign body, its awkward shape, or its slippery surface, the incision should be made in the direction of the coccyx, as less likely to cause hemorrhage and other mischief. When the substance has slipped very high up into the bowel, the extraction may be aided by counter-pressure upon the hypogastrium, thereby steadying the extraneous body, and enabling the surgeon to take a better hold upon it. To render the pressure effective, the bladder must previously be emptied.

Sharp, rough, pointed, or spiculated bodies may require to be sheathed before removal, to prevent mischief to the mucous lining. In the celebrated case of Marchetti, in which a pig's tail, rendered as rough as possible by cutting off the bristles near the surface, was introduced into the rectum with the but-end uppermost, a strong cord was secured to the projecting extremity, after which a piece of reed was slipped over it into the bowel, which was thus defended from injury. An anal speculum, or hollow bougie, open above, would answer a better purpose; or, in the absence of this, a large rectum-bougie might be used. A long bone, stretched obliquely across the bowel, with its extremities firmly embedded in its walls, may require to be broken at its middle before it can be removed; or if it be very thin and not too hard, it may be cut in two with a pair of scissors, and each piece extracted separately.

Hardened fecal matter should be softened by repeated injections of warm water, or some mucilaginous fluid, and be afterwards extracted with a scoop, or spoon, or the handle of a long slender pair of lithotomy-forceps. The operation might also be performed with a very stout, double wire, bent into a hook at the extremity. Ascarides may be dislodged in the same manner; or they may be destroyed by filling the rectum with some stimulating liquid, as a mixture of spirits of turpentine, aloes, or garlic-juice, a popular remedy often employed with much benefit.

## ABSCESS OF THE ANUS.

The cellulo adipose substance at and around the anus is liable to inflammation, often terminating in the formation of an abscess. The abscess may be of the simple phlegmonous character, or it may be essentially strumous, as when it occurs in persons predisposed to phthisis. In the former case, the symptoms are always bold and well marked, the parts being greatly swollen and excessively painful; in the latter, on the contrary, they are often so mild that the patient is hardly conscious of the presence of the morbid action. Moreover, there is a great difference in regard to the progress of the two affections. In phlegmonous abscess, the disease advances rapidly, soon reaching its crisis; matter forms in abundance, and there is apt to be extensive destruction of the surrounding cellulo-adipose tissue, causing frightful separation of the rectum and anus. In strumous abscess, on the other hand, the progress of the disease is tardy, the matter is less copious, and there is less dissection of the bowel.

The *phlegmonous* abscess of the ano-rectal region sometimes shows itself at a very early period. I have met with it repeatedly in children under five years of age. It is generally caused by external injury, or by some irritation of the mucous membrane of the bowel, as a hemorrhoidal tumor, or the lodgment of some foreign body. The formation of matter is denoted by the usual symptoms, such as violent, tensive, throbbing pain, and an erysipelatous blush on the skin. More or less fever is present, and the patient experiences excessive suffering in attempting to evacuate the bowel.

The proper remedy consists in making an early and free incision, the surgeon not waiting for distinct fluctuation, well knowing that, if he do, the matter will be likely to cause extensive destruction of the cellulo-adipose tissue around the bowel, and the formation of a fistule, which he may afterwards find it extremely difficult to heal. During the incipient stages of the inflammation, preceding the deposition of matter, the case must be treated upon general antiphlogistic principles. Leeches and purgatives will be particularly beneficial.

The *strumous* abscess is often an insidious disease; the symptoms are generally very mild; there is little or no pain, perhaps, indeed, merely a sense of uneasiness; the swelling is slight, and there is seldom any sympathetic fever. The immediate cause of the disease is usually an ulcer seated low down in the rectum, admitting the ingress of mucus and feces in the circumjacent cellulo-adipose tissue. The matter exhibits the peculiar strumous peculiarities, and is often excessively offensive. The treatment is by early and free incision; but, despite this, the disease is almost invariably followed by fistule.

The bottom of the ano-rectal abscess is sometimes extremely foul, from the lodgment of dead cellulo-adipose substance, mingled with the discharges from the bowel. When this is the case, the parts must be freely divided, and washed out with solutions of the chlorides, or of nitric acid. When the skin is much riddled, or quite cribriform, as it is apt to be when the matter has been long pent up, the openings should be laid into one.



## FISTULE OF THE ANUS.

One of the most frequent diseases of the anus is fistule, by which is meant an abnormal track, extending from the rectum to the surface of the skin. Occurring at all periods of life, it is most common in adults and elderly persons, childhood and old age being almost exempt from it. I have, however, witnessed it several times in young children, and in one case, in a girl only three years and a half old. Recently I had a boy, six years old, at my College Clinic, in whom the disease began at the age of nine months. After the age of fifty it is very rare, while after that of sixty it is almost unknown. The disease is more frequent in men than women, but in what ratio has not been ascertained; judging from my own experience, I am inclined to look upon the difference as very marked, for, while I have seen a large number of cases in the male, I have met with very few in the female. The difference could not, I am sure, have been accidental, my practice having always been pretty equally divided between the two sexes. We know of no cause for this difference, and I, therefore, content myself with a bare statement of the fact. Nor are we any better off in regard to our knowledge of the influence of occupation; since the disease occurs in all classes of persons, farmers, day-laborers, mechanics, merchants, divines, and physicians. It is generally supposed that individuals who are in the constant habit of standing and riding on horseback are particularly prone to the disease, but if this be the fact, I have not learned anything that goes to substantiate it. The idea has also been extensively prevalent that consumptive persons are very liable to suffer from anal fistule, but here again there is no proof that this is the case. We undoubtedly occasionally meet with phthisical subjects who are thus affected, but that the occurrence is at all common is not true.

The immediate *cause* of this complaint is an abscess in the neighborhood of the anus, of the nature previously described. In this manner, the lower bowel is not only more or less extensively detached from the surrounding structures, but its wall is perforated, so as to admit, in many cases, of the passage of gas, mucus, and fecal matter from its interior to the surface of the skin. When such a communication exists the fistule is said to be complete; if, on the other hand, the wall of the bowel retains its integrity, the abnormal track extending merely from the skin to its outer surface, then the fistule is incomplete, and is called, in reference to its situation, an external blind fistule. I have seldom seen what writers have designated as an internal blind fistule, that is, a cul-de-sac, extending from the rectum, or ano-rectal cavity, into the subjacent cellular substance, without perforating the common integument. Even the external blind fistule is, I am inclined to think, much more rare than is commonly believed; for there is no question at all in my mind that in many instances supposed to be such, the surgeon, from awkwardness or other causes, is unable to find an opening in the rectum, when one actually exists. I have myself been repeatedly baffled in this way where the history of the case gave the strongest evidence to suppose that the tube had been perforated.

There are three circumstances about the anatomy of a fistule that are worthy of particular attention; its external orifice, its course, and its internal orifice, for just in proportion to our knowledge of these will be likely to be the success of our treatment.

Until the early part of the present century the opinion of surgeons respecting the situation of the *internal orifice* of anal fistule was exceedingly vague and erroneous, and the consequence was that patients were often subjected to the most cruel and dangerous operations when relief might have been obtained by the most simple, the knife being generally carried two, three, and even three inches and a half up the gut in search of the internal opening. It is now well ascertained that the aperture, instead of being placed at this altitude, rarely extends higher up than three, four, or five lines from the verge of the anus, or the junction of the mucous membrane and the common integument. Occasionally it is a little higher up, and in a few rare instances it has been known to be ten, fifteen, or even eighteen lines above the verge of the anus; but of such an occurrence I have seldom observed any examples, ample as my experience has been in this affection. The internal orifice is generally single, but now and then it is multiple, as in the case of a gentleman, aged twenty-four, of Ripley, Mississippi, whom I treated for this disease in 1855, and in whom there were four distinct internal openings, about half an inch above the verge of the anus, two on the left side, one in front, and one on the right side. The size of the orifice is usually small, not exceeding half a line in diameter, and its shape circular or ovoidal.

The *external orifice* is generally situated at the side of the anus, at a distance varying from six or eight lines to several inches. Occasionally the track opens in front towards the scrotum, and sometimes, though rarely, directly over the extremity of the coccyx. Its shape is usually very irregular, and its size varies in different cases, from that of a pin-head to that of half a dime. Its site is generally indicated by a small, mammillated mass of granulations, or by a small, reddish point, perhaps not larger than a flea-bite, and quite tender to the touch. The external orifice is not always single; I have repeatedly seen two, three and even four openings, and in the adjoining sketch

Fig. 397.



(fig. 397), taken from a specimen in my private collection, there are as many as seven, giving the cutaneous surface quite a cribriform aspect.

The fistulous *track* itself, like its two orifices, is liable to much diversity, both as it respects its size and direction. While in some instances it is only a few lines long, and hardly large enough to admit the finest probe, in others it is several inches in length, and so capacious as to permit the passage of a large instrument. In its direction it may be straight, curved, or angular; in its shape, cylindrical, slit-like, or flattened. When several such tracks exist, they generally communicate with each other laterally, although they may all concen-

trate at one internal orifice. Raw at first, they always become lined, soon after their formation, by a layer of lymph, which, in time, closely assimilates itself to the mucous membrane of the bowel. The abnormal track is always bathed with pus, or sanious fluid, and often affords vent to flatus and even fecal matter. In external blind fistule, the passage terminates above in a pouch or hollow, which is sometimes quite capacious, from the great destruction of the cellulo-adipose substance around the gut.

In consequence of the passage and retention of mucus and feces in the parts more immediately implicated in this disease, the skin and cellular tissue are often very much indurated for a considerable distance around the anus, as well as hypertrophied, discolored and more or less tender. Sometimes small abscesses form, discharging thin, unhealthy matter; defecation is painful, the bladder is irritable, and the patient finds it difficult to sit, to ride on horseback, and even to walk much. When there has been considerable loss of cellulo-fatty substance around the fundament, the pus and fecal matter, lodging in the sac thus formed, become new sources of annoyance, inflammation, and fetor.

The *general health* in anal fistule does not necessarily suffer, though we often find it much impaired at the time of the occurrence, or during its progress. This is more especially the case when the complaint is coincident with tubercular phthisis or other organic disease, or when the parts are constantly kept in an irritable and painful condition from the lodgment of pus and fecal matter, and the consequent formation of abscesses and sinuses.

The *diagnosis* of anal fistule is a matter of great interest. The existence of the disease may be suspected when there has been an abscess in the neighborhood of the ano-rectal region, which is long in getting well; when the parts are habitually tender, tumid, and indurated; when there are one or more openings in the skin giving vent to a purulent or sanguinolent discharge, sufficient to moisten the skin and stain the linen; and, finally, when the patient is conscious of the occasional escape at the abnormal openings of gas, mucus, or fecal matter. To determine the fact, however, unequivocally, a thorough exploration is necessary, the best instrument for conducting it being a common pocket probe, well oiled, and introduced through the external orifice, the existence of which, as previously stated, being generally indicated by a small papilla on the skin. The left index-finger, being inserted into the rectum, feels for the point of the probe, and thus assists in guiding it to the internal orifice of the fistule, provided this is present, or against the side of the gut, when the fistule terminates in a cul-de-sac. As this manipulation is always productive of pain, it need hardly be added that it should be conducted with the greatest possible gentleness. When the parts are much inflamed, perquisition is preceded by rest, leeches, iodine, astringents, and anodyne enemata. The morning previously, the bowel is washed out well with tepid water. If much difficulty is experienced in detecting the internal orifice, use may be made of the speculum.

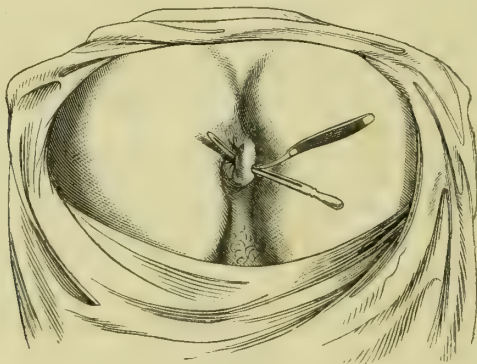
A patient affected with fistule of the anus may, under ordinary cir-



cumstances, be rendered comparatively comfortable by attention to his diet and bowels, and the observance of cleanliness. Some persons, indeed, are hardly conscious of their infirmity, so slight is their suffering; others, on the contrary, experience a great deal of local distress and even considerable impairment of the general health. When this is the case, a long course of general treatment may be necessary before we can bring about such a state of the part and system as to justify operative interference. It need hardly be said that all attempts at a radical cure are inadmissible when there is serious organic lesion in other parts of the body, especially the lungs. To arrest the local irritation and its attendant discharge would, under such circumstances, prove highly detrimental, by expediting the fatal crisis. Palliation alone is sought, not cure; or cure, slow and chronic in its action, occupying months instead of weeks in its accomplishment.

The most eligible operation for the cure of anal fistule is division of the superimposed structures with the knife, passed along a grooved director, previously inserted into the abnormal track, its extremity being brought out at the anus, and placed against the opposite buttock, as represented in the annexed fig. 398. With this precaution, the

Fig. 398.

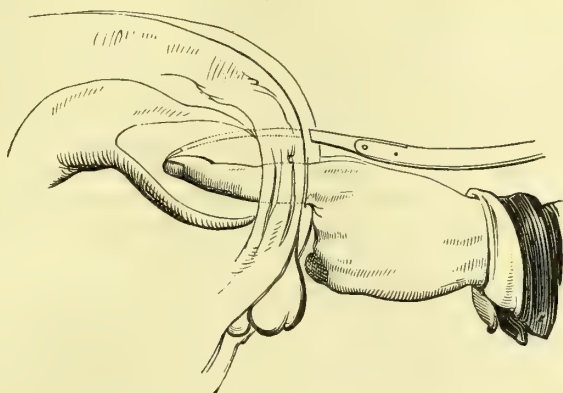


operation may be performed in a few seconds, and without the slightest risk of doing injury to the rest of the bowel. When the fistule is very short, I sometimes carry a narrow, probe-pointed bistoury through it, and effect its division in that way, counter-pressure being made against the extremity of the instrument by the finger in the rectum, as seen in fig. 399. When there is no internal orifice, as when the fistule is a blind external one, an opening must be made into the bowel at the usual height, with a sharp-pointed director, when the parts are divided as in the former case. When the track is of long standing, and incruited with organized matter, the cure will be rendered more certain, as well as more rapid, by notching its bottom, or even scraping away the adventitious matter.

The operation being over, a thin tent, well oiled, is inserted into the wound, its superior extremity being carried several inches up the

bowel, to insure its retention. A compress and T-bandage complete the dressing. The patient now goes to bed, a grain of morphia being

Fig. 399.



given to allay pain and prevent any action on the bowels for at least forty-eight hours. At the end of this time a mild laxative or enema may be administered. The dressings are renewed daily until the wound is pretty well closed by granulations, when they may be dispensed with. Too much stress cannot be placed upon these measures.

It is seldom that more than a few drachms of blood are lost in this operation, whereas in the old process, where the knife was carried several inches above the anus, the hemorrhage was generally quite profuse and sometimes even fatal. In cases of long standing, attended with great callosity of the parts, I have several times noticed a considerable flow of blood, apparently from an inability of the vessels to retract themselves into the condensed cellular substance. When this happens, exposure of the wound to cold air, and the application of pounded ice, astringent lotions, or compression, will, in general, speedily put a stop to it.

The operation by the *seton*, suggested by Hippocrates, and so much in vogue among charlatans, on account of its freedom from pain, and its non-interference with exercise, is certainly not without its advantages. It is particularly applicable, I conceive, when there are several internal openings, and also when there is danger, as in the use of the knife, of effecting too speedy a cure when the fistule is complicated with serious organic disease of the lungs, heart, or liver. In such a case we cannot be too cautious, lest in arresting too suddenly a discharge which has perhaps become habitual, we throw the onus upon the more important organ, and thereby induce death much sooner than it would otherwise occur. When, then, under such circumstances operative interference is demanded on account of the local distress, we content ourselves with the *seton*, aiming at a slow cure, or perhaps simply amelioration. When there is a multiplicity of internal openings, situated at different parts of the bowel, as in the case previously adverted to, the employment of the knife could hardly fail to be followed by loss of power in

the sphincter muscles. In that case, I inserted not less than three setons, and had the satisfaction of effecting a complete cure in less than a month.

The most suitable substance of which such a seton can be made, is what is called silk twist, about the thickness of common twine; and the best instrument for inserting it is a silver probe, very slender, and about two inches and a half long. The ends of the ligature are secured over a small button, having two holes at opposite points, and are tightened once every second or third day, until they cut their way out, as they usually will in less than a fortnight; the patient being all the while able to walk about and attend to his business, not neglecting, however, attention to cleanliness, and to his diet and bowels.

#### ULCERATION AND FISSURE.

Ulcers of various kinds are liable to occur in the anus, and to give rise to great suffering. They take place in both sexes, but in what proportion we are unable to say. Persons from twenty to forty are, according to my experience, most obnoxious to them, but I have occasionally met with them before the age of puberty, and also in old subjects. The most common form in which they present themselves is in that of chaps, cracks, or fissures, seated just within the verge of the anus, or partly within and partly without; in the former case, they involve only the mucous membrane; in the latter, both the mucous membrane and skin. Persons who suffer from herpetic affections of the nose and lips, sometimes experience similar attacks at the junction of the cutaneo-mucous surface of the anus, the parts looking as if they were cracked, at the same time that they are red and prurient, the patient being obliged to use his finger to relieve himself. Children and young adults are often afflicted in this manner, sometimes as a result of worms, but more generally as a consequence of derangement of the digestive organs. Occasionally the lesion exists as a complication of hemorrhoids, cancer, and other diseases, especially when they are attended with acrid discharges. Diarrhoea, dysentery, and infantile cholera may also produce it.

A much more serious form of ulcer than the one just described is what is termed *fissure* of the anus. This is generally situated just above the verge of the anus, extending from the skin upwards through the mucous membrane, in the form of a groove, slit, or gutter, from half an inch to an inch in length; its width generally not exceeding half a line, or, at most, a line. The bottom of the ulcer is usually formed by the submucous cellular tissue, and exhibits a pale, grayish aspect, while its edges are generally everted, tumid, and indurated, the parts immediately around being red and inflamed. In rare cases the ulcer extends down to the fibres of the sphincter muscle. I do not know that one part of the anus is more liable to this affection than another, but I am sure that I have met with it most commonly behind, or just in front of the coccyx. It may be single or multiple, the former being the more frequent. Very recently I saw an instance in which one fissure was situated in front, opposite the perineum, and



another behind, opposite the coccyx. Cases have come under my observation where the mucous membrane, just within the verge of the anus, was studded with small, superficial ulcers, of a circular or oval form, from the size of a split mustard seed to that of a currant.

Ulcers of the mucous membrane of the anus, or ano-rectal region, generally come on without any assignable *cause*. Indeed, nothing could be more insidious in its mode of origin than the disease known as fissure of the anus. How it arises no one pretends to understand. In dysentery and chronic diarrhœa ulcers occasionally form in this region, but they seldom prove either painful or difficult to heal. Similar lesions are known to occur during the progress of hemorrhoids and prolapse of the bowel; and the anal sacs are sometimes ulcerated, apparently from the lodgment of irritating fecal matter, or of a foreign body, as a fish-bone or apple-core. The malady may be of a venereal character, being caused either by direct inoculation, by extension from the genital organs, or by constitutional taint. The diagnosis of the case rests upon the indurated condition of the sore, its situation at the cutaneo-mucous surface, its foul appearance, and its intractable character, together with its history. Finally, there is a form of follicular ulcer of the rectum, caused by the softening of tubercular matter; it is generally connected with tubercular phthisis, and not unfrequently leads to the formation of anal abscess and fistule.

Whatever may be the form and character of these ulcers, whether common or specific, simple or complicated, the mucous membrane, in their immediate vicinity, is generally in a state of disease, the most ordinary changes being discoloration, induration, and tumefaction. The bottom of the sores is often covered with lymph, and their edges are either flat and superficial, ragged and undermined, or elevated, hard, and everted. When large or numerous, there may be more or less discharge of pus, muco-pus, or sanies, fetid and irritating in its character.

The *symptoms* of ulceration of the anus and rectum vary much in different cases and under different circumstances, being sometimes very mild, and at other times excessively severe. In anal fissure, the suffering often amounts to great torture, especially during defecation, as well as for some time after; it is generally attended with violent spasmodic contraction of the sphincter muscles, tenesmus, and straining, a feeling of weight in the parts, and a sense of soreness in the perineum, thighs, and sacro-coccygeal region. The distress is always aggravated by riding on horseback, sexual intercourse, walking, and even by sitting upon a hard chair. The introduction of the finger is sure to bring on a paroxysm of suffering, almost amounting to spasm. The bladder soon becomes irritable, and intolerant of its contents; the general health gradually fails; the countenance assumes a sallow, sickly expression; the strength declines; and everything denotes the terrible impression which the disease has wrought upon the mind and body of the patient. The state of the bowels varies; sometimes they are relaxed, sometimes constipated; but, however this may be, the calls of nature are always postponed as long as possible, from the fact

that the passage of the feces is invariably accompanied and followed by the most frightful agony.

Muco-cutaneous fissures of the anus, the *rhagades* of the older surgeons, are seldom productive of much pain, unless the bowels are permitted to become costive, or otherwise diseased, when they may cause severe suffering, and even considerable constitutional disturbance. One of the most unpleasant symptoms attending them is an itching or stinging sensation, aggravated by exercise and the use of all kinds of stimulants. Tubercular ulcers seldom occasion much uneasiness, while venereal are usually very painful, and productive of constitutional disorder.

The existence of ulcers of the anus, or ano-rectal cavity, can only be determined by ocular inspection; hence the cautious use of the speculum is indispensable to a correct diagnosis. When the sores are large or numerous, the sense of touch will sometimes be sufficient to detect them, but the only certain way is to expose them to view in a good light, as this affords the surgeon an opportunity, not only of observing their seat, but also their size and condition, thereby enabling him to institute a more scientific plan of treatment.

In the *treatment* of ulcers of the anus and rectum, much may be done by attention to the general health, and especially to the state of the digestive apparatus, which is often much deranged. The bowels must be maintained in a soluble condition by mild laxatives, such as Epsom salts or castor oil, or, what is better, enemata of cool water, which, while they cause riddance of fecal matter, relieve congestion and promote cleanliness. In the intervals of the enemata, the parts may be soothed with small quantities of some mucilaginous fluid, containing a suitable proportion of laudanum or morphia. The diet is bland, non-stimulant, and concentrated. As far as direct applications are concerned, it is obvious that we must be governed in our choice by the nature of the ulcer. In the herpetic sores of the anus, the best topical remedies are the weak yellow-wash, and the dilute ointment of the oxide of zinc, or Turner's cerate, aided by a mercurial purgative and spare diet. In anal fissure, hardly anything short of the use of the knife will be of any benefit, experience having shown that the treatment by nitrate of silver, acid nitrate of mercury, lotions, and unguents, is, in general, entirely unavailing, however judiciously or perseveringly employed. Until lately, the idea prevailed that the chief reason why this ulcer was so disinclined to heal was the motion to which it was subjected by the action of the sphincter, and hence it was proposed, in order to insure quietude of the part, to divide this muscle. For many years I acted upon the principles of this suggestion, until I found that the mere division of the bottom of the fissure answered just as well in affording relief, while it saved time and inconvenience. All, indeed, that need be done, at least in the milder forms of the malady, is to press the knife into the bottom of the fissure, and to trim its edges, if they are at all high and elevated, with the scissors. When there is much congestion in the surrounding surface, slight scarification may be practised. In this manner, a patient who has been racked and tortured with pain and spasm for months, may be relieved of all his

suffering in a few seconds. Should the case prove obstinate, the knife is carried through the sphincter muscle, as in anal fistule. The after-treatment consists in repose in the recumbent posture, abstinence, cold enemata, and mild laxatives, after the first three days.

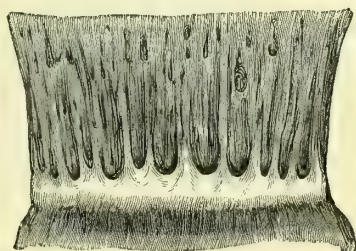
When the ulcer is situated above the sphincter muscle, our main reliance is placed upon the acid nitrate of mercury, until there is a tendency to cicatrization, when the occasional use of nitrate of silver, applied as lightly as possible, may be trusted in for perfecting the cure. Syphilitic ulcers require, besides the ordinary topical remedies used in the treatment of that disease, the internal exhibition of mercury and iodide of potassium.

## SACS OF THE ANUS.

A singular affection of the anus, first described by Dr. Physick, under the name of the encysted rectum, is occasionally met with, though comparatively seldom. A more appropriate appellation for it would be sacciform disease of the anus, as it consists simply in an altered condition of the sacs, pockets, or pouches naturally existing in this situation to the number, in many cases, of eight, ten, or even a dozen, as seen in fig. 400, from a specimen in my cabinet. These sacs are always very small in early life, but as their development is regularly progressive they are capable of acquiring a considerable size, especially if, as not unfrequently happens, they form the receptacles of hardened feces, inspissated mucus, or small extraneous bodies. From these and other causes, not always very obvious, they become the seat of morbid action, as inflammation, suppuration, and ulceration, often attended with exquisite torture. A number of pouches may be thus affected simultaneously, or one after another may become involved, until nearly the whole of the anus may suffer. The size of the individual pockets varies from that of a small depression, hardly capable of holding a split pea, up to that of a cavity large enough to admit the point of the little finger. The disorder occurs only, or principally, in old subjects, whose lower bowel is habitually distended with fecal matter, and who suffer much from congestion of the ano-rectal tissues.

Sacciform enlargement of the anus is generally tardy in its progress, and insidious in its character, its existence being frequently not suspected for years. For a long time the patient is merely conscious of uneasy sensations in the parts; vague as to their nature, and uncertain as to their recurrence. Frequently one of the earliest symptoms complained of is a feeling of pressure or weight just within the anus, or a distressing itching, similar to what is produced by the presence of ascarides. As the disorder proceeds, but generally not until it has made considerable progress, the patient begins to experience pain,

Fig. 400.



Pouches of the rectum.



especially immediately after defecation, lasting often several hours after the act has been completed; it is commonly of an aching, burning, or smarting character, and is seldom confined to the parts more immediately implicated, but is apt also to extend to the buttocks, the perineum, back, and thighs. It is not, however, after every evacuation that there is severe pain; cases occurring in which it is entirely absent, or nearly so, for days together, depending probably upon the fact that the affected pouches are sometimes completely emptied of their contents, and, of course, relieved from pressure. An increased secretion of mucus is usually observed, but it is rare, except when the sacs are inflamed or ulcerated, to see any discharge of pus. No spasm of the sphincter muscles accompanies this affection, as is the case in fissure of the anus. To ascertain the real nature of the disease, careful exploration is necessary, the instrument used for the purpose being a common pocket probe, the end of which is bent into a hook, and passed up and down the anus from one part of its circumference to the other. As it is drawn along it becomes entangled in the valve-like fold of the sac, the seat, size, and sensibility of which are thus fully revealed, and which is generally so transparent as to allow the probe to be perceived through it. The examination is always painful, and it may, therefore, be made while the patient is under the influence of chloroform.

The proper remedy for this complaint is excision of the valve-like fold of the affected sac. To do this, all that is required is to draw it down with a tenaculum, or seize it with the forceps, and snip it off. If the bottom of the pouch is in an ulcerated condition, it will be well at the same time to scarify its surface, in the hope of placing it thereby in a more favorable condition for speedy reparation. If several sacs are involved, they should all be operated upon at one sitting.

#### PROLAPSE OF THE RECTUM.

Prolapse of the anus, or, more properly speaking, of the rectum, presents itself under two varieties of form, the partial and the complete; the former consisting merely of a portion of the mucous membrane of the gut, the latter of the entire tube. The affection is of frequent occurrence, especially in children and aged persons, in whom it often exists in a very high degree. Various causes are capable of producing it, among which the more important are chronic diarrhoea and dysentery, habitual constipation, or constipation alternating with diarrhoea, hemorrhoids, ulcers, ascarides, and the use of drastic cathartics; anything, in short, that acts obstructingly to the evacuation of the feces and urine, may be considered as an exciting cause of the complaint. Hence, persons laboring under stricture of the urethra, enlargement of the prostate gland, or stone in the bladder, are exceedingly prone to be affected with prolapse of the lower bowel. Some of the very worst cases of the disease that I have ever met with occurred in subjects of this description. Females sometimes suffer from falling of the bowel in consequence of the straining which they experience in the evacuation of the urine and feces from the pressure occasioned by a displaced

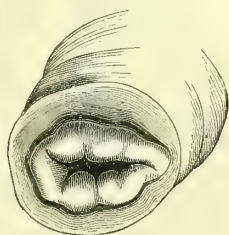
uterus. Similar effects may be produced by a pelvic tumor. A partial displacement of the bowel occasionally attends hemorrhoids.

As predisposing *causes* of prolapse of the bowel may be enumerated constitutional debility, want of tone in the sphincter muscles of the anus, and relaxation of the intestines, however induced. Children and old persons are more prone to the disease than adults and elderly subjects. In the former, the rectum is straighter and more movable than in adolescents, the sacrum is less curved, and the abdominal viscera are more voluminous, thereby bearing more severely upon the anus and rectum during the forcible contraction of the diaphragm and abdominal muscles, both in the ordinary state and during defecation. In this way the parts becoming relaxed are readily protruded during the operation of any exciting cause, as, for example, severe and frequent straining. In old persons a predisposition to this malady is established by the relaxation of the connecting ligaments of the lower bowel, brought on by the natural wear and tear of the body.

In the incomplete *variety* of prolapse (fig. 401), the protrusion usually shows itself in the form of a fold of the mucous membrane on each side of the anus, though sometimes there may be two or even three such tumors, lying close together, or one just above another. They are, at first, always of a florid complexion, soft, spongy, elastic, and free from tenderness; but after they have existed for some time they assume a dark appearance, from the congested state of their vessels, increase in hardness, and become the seat of more or less pain. The facility with which they are returned is also much greater in recent cases; for, as they grow larger and older, the submucous cellular tissue is infiltrated with sero-plastic matter, rendering them firm and rigid, and thereby less easy of replacement, or of spontaneous reduction. When a protrusion of this kind is permanent, it is liable to become congested, inflamed, hypertrophied, rough, coriaceous, and even ulcerated; gangrene itself is not impossible, though fortunately very rare.

The second variety of prolapse consists essentially in an invagination of the lower bowel, the portion thus affected being at the same time propelled beyond the orifice of the anus to the extent of several inches (fig. 402). The ensheathed and prolapsed portion may be the middle or upper part of the rectum, or the inferior extremity of the sigmoid flexure of the colon, or all these parts may be involved at the same time. The amount of protrusion varies from the slightest possible descent of the bowel, to a mass as large as a fist, a foetal head, or even the head of an adult. The most enormous prolapse of the intestine that I have ever seen, occurred in a man, about thirty-five years of age, who came to consult me from Mississippi. He was married, and had several children; the disease had troubled him for a long time, and the tumor was fully as large as the crown of an ordinary sized

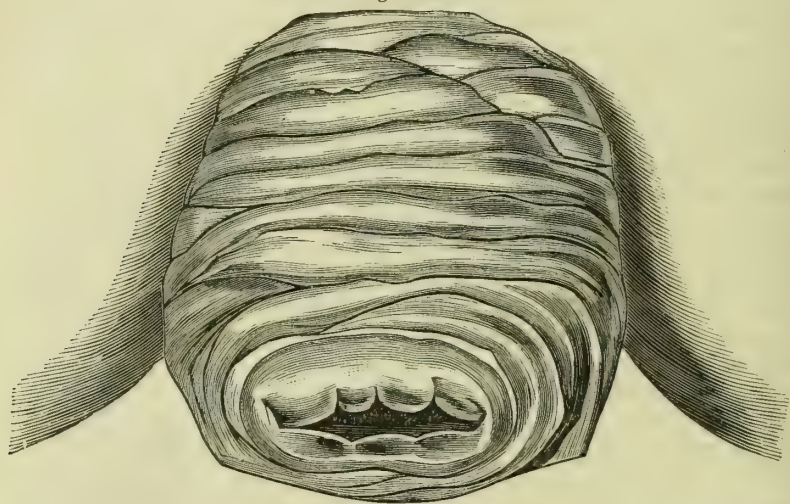
Fig. 401.



Partial prolapse of the rectum.

hat. A more bulky mass of the kind could, indeed, hardly be imagined; it seemed as if it might consist almost of the whole of the large intestine; it certainly could not have been merely the rectum and sigmoid flexure of the colon. In general, the tumor thus formed is comparatively small, not exceeding two and a half inches in diameter;

Fig. 402.



cylindrical in shape, truncated at the extremity, of a florid color, rugose on the surface, slightly sensitive to the touch, and readily reduced by the finger, or even ascending of its own accord, but liable to recur whenever there is the least straining at stool or micturition. When the protrusion is permanent, the parts undergo the same changes as in the partial variety of prolapse, being congested, inflamed, indurated, hypertrophied, and invested with a kind of epidermis. From constriction of the sphincter muscles the tumor is liable to strangulation, but such an occurrence is more likely to happen in recent cases than in such as are of long standing, which are always attended with proportionably greater relaxation of the compressing agents.

A protrusion of the lower bowel necessarily implies the pre-existence of a certain degree of relaxation of the parts constituting the floor of the pelvis and the muscular apparatus of the anus. So long as these several structures retain their accustomed vigor and contractile energy, no descent, however small, can occur; but when they lose their tone, the intestine being at the same time enfeebled, and subjected to inordinate pressure by the diaphragm and abdominal muscles, the accident in question can hardly fail to take place. In cases of long standing, all these parts, as I have had an opportunity of ascertaining by dissection, are not only greatly relaxed, but remarkably atrophied, the skin being attenuated and plicated, the adipose matter partially absorbed, and the fibres of the sphincter muscles pale, elongated, expanded, and almost wholly destitute of contractile power. Similar



alterations are wrought in the fibres of the elevator muscles of the anus. That such effects should occur is very reasonable to suppose when we reflect upon the amount of traction and compression to which these structures are habitually subjected by the protruded mass.

*Treatment.*—In the more simple forms of this accident, whether partial or complete, a cure may often be effected by very simple means. Before the practitioner, however, institutes any method of treatment, he should make careful inquiry into the nature of the exciting cause, for by removing this, the affection often speedily disappears of its own accord. Thus, if the patient has diarrhoea, or some mechanical obstruction along the course of the urethra, impeding the flow of urine, and, consequently, requiring great effort to overcome it, it is obvious that no course of treatment, however judiciously managed in other respects, can avail anything until these complaints are relieved. In all cases, whatever may be the nature of the exciting cause, it is of paramount importance to attend to the general health, which, as was previously stated, is often much at fault, the secretions being deranged, the digestion enfeebled, and the bowels either too free or too constipated. To meet these indications the occasional use of a blue pill, or of a few grains of calomel and rhubarb, or of gray powder, will be of service, followed, if necessary, in the morning by a little Epsom salts, or castor oil. When acidity and flatulence prevail, alkalies must be used along with tonics, as quinine and iron, or iron and some vegetable extract. The diet should consist mainly of bread and meat, if the patient be an adult, or of bread and milk, if he be a child, with an occasional allowance of rice, hominy, or potato as a change. The skin should be maintained in a perspirable condition by the tepid bath, or daily ablutions, and frictions. In all cases, and in both forms of the disease, the sufferer should be compelled to pass his feces and urine in the recumbent posture, as the pressure which is exerted in this way by the diaphragm and abdominal muscles upon the anus and rectum is much less than when these discharges are effected in the ordinary manner. This is a point, in the treatment of prolapse of the bowel, upon which it is impossible to lay too much stress. Replacement should always be effected immediately after every protrusion, and measures should be employed, in the intervals, calculated to prevent this occurrence, as astringent enemas, containing a sufficiency of laudanum to insure the tranquillity of the parts, or a pretty full anodyne by the mouth. When the bowel is inflamed, the best remedies will be an injection of some mucilaginous fluid, and an emollient poultice to the anus. Keeping the bowels locked up for three or four successive days often produces the happiest result.

When, in consequence of their long extra-anal sojourn, the parts have become abnormally thickened, indurated, and stiffened, thereby impeding their restoration, great benefit will accrue from leeching, the application of a very weak solution of iodine, punctures, and scarifications. In recent cases, more especially, it sometimes happens that the tumor becomes partially strangulated, from the constriction exerted upon it by the sphincter muscles; in such an event no time must be

lost in effecting reduction, the efforts being promoted by the use of chloroform, and the thorough elevation of the nates, the thighs being at the same time widely separated from each other. Gentle, but steady pressure being now made upon the tumor, no difficulty will generally be experienced in accomplishing our object; should the resistance, however, be obstinate, it may be promptly overcome by dividing a few of the fibres of the sphincter muscles on each side of the anus.

Not much is to be expected, in any case, from the use of retentive apparatus, which can never be worn with any comfort either by the young or old, while in many cases it is productive of positive inconvenience and even suffering. Instead of this, it is much better, in both varieties of prolapse, to remove a portion of the mucous membrane, on each side of the anus, with the ligature, with the hope that during the cicatrization the caliber of the tube will contract sufficiently to prevent relapse. One such operation may suffice in ordinary cases, but when the protrusion is extensive it may be necessary to repeat it; not, however, without caution, lest injurious contraction ensue.

In the complete form of the affection, especially when of long standing, a more complicated course is sometimes required, consisting in the excision of some of the cutaneous folds of the ano-gluteal region. Several of these are raised at each side of the anus with the forceps and cut off at their base along with some of the subjacent tissues, and even a few of the muscular fibres, especially if they are found to be much stretched and atrophied, the edges of the wounds being afterwards tacked together by several points of the interrupted suture. It will generally be well to carry the knife as far as the junction of the skin with the mucous membrane. By this operation, contraction of the anal orifice is hoped for, and will rarely disappoint expectation. When it fails, a V-shaped piece of the anus may be removed at each side, approximation being effected and maintained by suture, very much as in hare-lip. Some years ago, I assisted my friend, Professor T. G. Richardson, in such an operation, but, although it was well executed, no appreciable benefit resulted. The patient was a middle-aged woman, who had for years labored under an immense prolapse of the lower gut, attended with great and permanent relaxation of the integuments and muscles of the anus, which resisted every mode of treatment that could be devised.

#### HEMORRHOIDS.

Of hemorrhoids there are two distinct varieties, differing in their situation, in their structure, and also in regard to the treatment required for their relief. Besides these, there is occasionally a dilated and varicose condition of the hemorrhoidal veins, simulating ordinary piles, and equally productive, at least in many cases, of severe suffering.

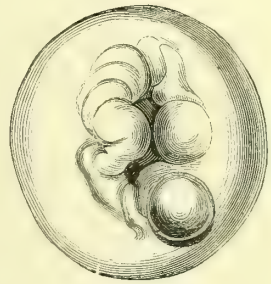
a. *External Piles.*—The most common variety of this disease is what is called the external pile, as it is always seated at the verge of the anus. It consists essentially in an extravasation of blood into the cellular

tissue of the part, caused by the rupture of a hemorrhoidal vein, the tumor being covered partly by skin and partly by mucous membrane. As the effused blood always speedily coagulates, the tumor soon becomes hard, firm, and inelastic, its contents rolling out, after an incision has been practised, like a solid mass, of a dark purple color, and without any admixture of serum. The sac in which the blood is contained is generally composed, in part, of the ruptured coats of the vein, the remainder being formed, as already stated, by the connecting areolar substance, the cells of which are generally speedily closed by plastic matter. Sometimes, again, the tumor is formed exclusively by a sac-like expansion of the vessel, attended with the solidification of its contents, both there, and for a short distance above the verge of the anus. The latter arrangement, indeed, exists in nearly all cases of external piles; hence, if an incision be made into such a tumor, and its contents pressed out, no bleeding follows, as there necessarily would if the vein were not effectually occluded by blood and lymph. The appearances of the external pile are well illustrated in the adjoining cut (fig. 403), from a preparation in my private collection.

It will thus be perceived that this variety of hemorrhoids bears a close resemblance to apoplexy of the parenchymatous organs, and, what adds still farther to the similitude is that the effused blood, if not removed by operation, is either entirely absorbed, or, as more commonly happens, a portion of it remains, becoming organized, and transformed into a solid, fibroid tumor.

The size of the external pile varies from that of a pea to that of a pigeon's egg, the largest being usually seated at the side of the anus, as it is not only there where the largest hemorrhoidal veins exist, but also where there is the greatest amount of cellular substance, thus admitting more readily of their expansion. In regard to their number, there may be only one, or as many as three, four, or even five, though this is rare. Their color varies with the structure of the external covering, the cutaneous part being usually light, while the mucous part is of a dark or purple aspect, owing to its greater vascularity. An inflamed external pile is always of a deeper color than one that is not inflamed. An external hemorrhoid is usually very sensitive, the patient complaining of a feeling of weight, distension, and throbbing, which are sure to be increased by the erect posture, by walking, and by whatever has a tendency to cause a flow of blood to the anus and neighboring parts. If, from these and other circumstances, it becomes inflamed, the suffering is greatly aggravated, the tumor assuming a dark red appearance, at the same time that it is hot, swollen, and shining, from sero-plastic infiltration of the connecting cellular tissue. If the morbid action be not promptly checked, abscesses will be likely to form, attended with enormous tumefaction, and perhaps followed by a fistule.

Fig. 403.



External hemorrhoids.



This variety of tumor sometimes occurs at a very early period, several well-marked cases having fallen under my observation in children under four years of age. Young girls are, I am inclined to believe, more prone to suffer than boys. After the age of puberty, however, males suffer more frequently than females; at least, such is the result of my own experience.

The predisposing *causes* of external hemorrhoids are whatever has a tendency to create congestion and dilatation of the hemorrhoidal veins; as habitual distension of the rectum, the pressure of pelvic tumors, tight lacing, frequent sexual intercourse, riding on horseback, and the constant maintenance of the erect posture. Another predisposing circumstance is an unnatural development of these vessels, either congenital, or coming on soon after birth, just as occasionally happens in the saphenous veins in persons who suffer from varicose disease of the lower extremity. The exciting causes are straining at stool, impacted feces, riding on horseback, and the pressure of the child's head during parturition, or whatever has a tendency to distend and rupture the hemorrhoidal veins. Finally, the external pile may occur alone, or it may co-exist with the internal pile, as well as with various other affections, as prolapse, fissure, stricture, carcinoma, and polypoid growths. When it has once occurred, the affection is extremely liable to reappear from the slightest causes. The history of the case, and a careful inspection of the part always suffice to establish the diagnosis.

Nothing can be more simple than the *treatment* of an external pile, and yet, for the want of a correct knowledge of its anatomy, hardly any disease is more frequently mismanaged. A simple incision is generally all that is necessary to afford prompt and permanent relief. The knife being carried through the centre of the swelling, down into the sac, its contents are gently pressed out, when a little attention to rest and the use of cold applications, will suffice to complete the cure. In many cases, indeed, if not in most, the patient is able to go about his business immediately after the operation, all suffering disappearing within a few minutes after the tension has been taken off the tumor. When several hemorrhoids exist, they should all be opened at the same time; and then it will also be more necessary to keep the patient on his couch to guard against increase of inflammation. It is seldom that the sac re-fills after it has been evacuated; but I have met with several instances where this occurrence took place promptly after the operation, evidently from a want of occlusion of the communicating hemorrhoidal vein. In such a case, further interference may either be postponed, or, if the tumor be not much inflamed, a ligature may be cast around it, the projecting parts being immediately cut off with the knife.

The treatment now described should be adopted in all cases of external hemorrhoids, whatever may be their condition. The presence of a high degree of inflammation is no contra-indication, but, on the contrary, a strong argument for the practice; for, as long as the effused blood is pent up there, so long must it be productive of mischief, by keeping up tension and irritation. Besides, as previously

stated, it never fails, if it be allowed to remain, to become organized, thus leading ultimately to the formation of a tumor, which is sure to be constantly in the patient's way in walking, riding, and defecation. A portion, it is true, is always absorbed, but enough is generally retained to cause more or less serious inconvenience for a long time afterwards.

b. *Internal Piles*.—The other variety of pile, usually called the internal, occult, or bleeding pile, differs very essentially in its structure from the preceding, being composed of a congeries of arteries and veins, in a varicose condition. The disease, in fact, bears a closer resemblance to what has been called aneurism by anastomosis, than to any other morbid structure of which we have any knowledge. The alteration which ultimately gives rise to the disease, begins in the submucous cellular substance, the vessels of which, originally so small as to be scarcely perceptible by the naked eye, gradually enlarge in volume, until they form, in many cases, considerable sized branches, tortuous, sacculated, and arranged so as to exhibit an intricate, retiform appearance, as delineated in fig. 404. The venous branches usually predominate, both in number and volume, as well as in their varicose disposition. The walls of both classes of vessels ultimately become diseased, being thickened in some places and attenuated in others, either alone or conjoined with softening, induration, or ulceration; and, therefore, liable to give way from the slightest causes under the impulse of their contents. Hence, as will presently be seen, such tumors are not unfrequently the seat of considerable hemorrhage, both arterial and venous. The tissues which connect the diseased vessels together, usually experience a certain degree of hypertrophy, though they rarely lose their softness and pliancy. The covering of the internal hemorrhoid consists simply of the mucous membrane, generally somewhat thickened, or thickened at one point and attenuated at another, and variously altered in its color and consistence. If, therefore, a section be made of such a tumor, it will be found to exhibit a porous appearance, the apertures corresponding with the calibers of the dilated arteries and veins of the part, and the solid structure with the parietes of the vessels and their connecting cellular substance, while the peripheric layer represents the mucous tunic of the bowel.

Fig. 404.



The minute structure of an internal hemorrhoidal tumor.

Internal piles are always *situated* above the verge of the anus, at a distance varying from a few lines to two inches and a half; in general, they are just above the level of the internal sphincter muscle. When occurring in considerable numbers, they are either grouped pretty closely together, or they are scattered over a considerable surface, involving, perhaps, the entire circumference of the ano-rectal outlet, as seen in fig. 405, from a specimen in my cabinet. It is seldom that we meet with only one such tumor; most commonly there are not less than two or three, and I have repeatedly seen as many as five, six, and even seven, varying from the size of a pea up to that of a large marble,

which they rarely exceed, unless they are solitary or of long standing, when they may be as large as a pullet's egg. Being ordinarily of a florid

Fig. 405.



Internal hemorrhoids.

complexion, they are often of a dark-bluish, purple, or livid aspect, especially when they are inflamed or partially strangulated, as when they are prolapsed, and compressed by the sphincter muscles. They are soft, spongy, erectile, and elastic, diminishing under pressure, but regaining their former volume the moment the pressure is removed. In their shape, they are usually globular, their attachment being effected by a rather broad base; sometimes, however, they are pyriform; and in rare cases they present themselves in the form of vertical semi-

cylinders, upwards of an inch in length by several lines in diameter. Their surface is originally smooth, but as they increase in age it often becomes roughened by deposits of lymph, or by the enlargement of the mucous villi. Ulcers are occasionally seen upon it, generally very small and superficial, but sometimes of considerable extent, and so deep as to penetrate the tumor, and cause more or less hemorrhage, thus constituting what is called a bleeding pile.

It is very rare that we meet with an internal hemorrhoid before the age of puberty; but after this period the affection is exceedingly common, in both sexes, in different classes of persons, and in different occupations. Persons who lead a sedentary life, with a gross habit of body, or who are constantly suffering with dyspepsia, or who labor habitually under constipation of the bowels, are particularly prone to the disease. Horseback exercise, the standing posture, diarrhoea, dysentery, worms, rectal tumors, drastic cathartics, and, in short, whatever produces frequent and severe straining, are so many predisposing causes of internal hemorrhoids. To the same category belong the different kinds of mechanical obstruction to the passage of the urine, as stricture of the urethra, enlargement of the prostate gland, and stone in the bladder; also the pressure of pelvic tumors, and of the gravid uterus. Under the influence of these and other causes the vessels of the submucous coat of the ano-rectal region are gradually converted into large varicose tubes, which, as they increase in volume, lift up the lining membrane, forming thus a soft, vascular, and erectile tumor, such as I have described.

Internal piles, unless large or numerous, are not productive of much suffering, the chief symptoms being a sense of weight and stuffing in the ano-rectal region; under opposite circumstances, however, there is frequently severe pain, throbbing, difficult defecation, and spasm of the sphincter muscles, with more or less prolapse of the anus, and also of the tumors themselves, especially when the patient is at the water closet. At such times the parts being compressed and congested, the suffering



is often so exquisite as to induce free perspiration and even partial syncope; from the same causes pretty copious hemorrhage sometimes results, the blood either oozing out at various points, as from the surface of a sponge, or spiriting out at one particular spot, corresponding with the orifice of an ulcerated or ruptured artery. The protruded parts being replaced, as they generally have to be, with the fingers, the distress gradually subsides, the patient remaining comparatively comfortable until he is again obliged to relieve his bowels, when there is an immediate recurrence of all the previous symptoms. Thus, the disease may progress for many years, the patient being now better, now worse; liable to frequent exacerbations and remissions; generally capable of attending to business, but rarely, if ever, entirely free from suffering for a single day; more comfortable at night, while recumbent, and worse after exercise, a hearty meal, a glass of wine, severe mental emotion, or sexual indulgence. Unless there is constantly recurring hemorrhage, it is astonishing how little impairment there often is of the general health. I have known repeated instances where, although the local distress was quite severe, entailing a certain amount of pain daily for many years, the individuals were able not only to attend closely to their occupation, but absolutely seemed to thrive under the disease, being robust and well-conditioned in every respect. Under such circumstances, it would really seem as if the hemorrhoidal irritation served to ward off disease from other and more important organs.

The quantity of blood lost during the progress of internal hemorrhoids is sometimes almost incredible. Cases are upon record where it is said to have amounted, daily, for many years, to two, three, five, six, and even eight ounces. Doubtless some of these cases have been exaggerated, but that many of them occurred just as they have been reported, is altogether probable. I have myself seen several instances where the daily loss thus sustained was so great as to reduce life literally to the very borders of the grave, and which were speedily relieved by the most simple operation. Excessive pallor of the countenance, vertigo, indistinctness of vision, ringing noises in the ears, palpitation of the heart, coldness of the extremities, indigestion, emaciation, and great impairment of the strength, with a tendency to dropsical effusions, are the most prominent symptoms of this occurrence. In the female this species of hemorrhage is sometimes vicarious of the menses. It is generally most abundant during defecation, or immediately after, especially if the parts have suffered protracted protrusion.

The *diagnosis* of this variety of pile is readily determined by the history of the case, by inspection, and by examination with the finger. The speculum can seldom be used to advantage, unless the patient is under the influence of an anæsthetic. If the disease has made considerable progress, the tumor or tumors can usually be easily brought down by requesting the patient to strain, as if at stool, while sitting on the chamber, or, what is better, in a tub of warm water. Their globular form, florid, bluish, or livid color, soft feel, and intimate attachment to the ano-rectal mucous membrane, will at once establish their identity and serve to distinguish them from the other diseases of this region. If the swellings cannot be seen, then the finger takes the place of the

eye, being carried about gently, but effectually over every portion of the bowel within its reach; aided, if need be, by the speculum.

The *treatment* of internal piles is palliative and radical. The former, which is often alone available, on account of the timidity of the patient, resolves itself chiefly into measures calculated to improve the condition of the digestive organs, to regulate the bowels, and to allay local irritation. It is wonderful how much good may frequently be done in this disease by attention to the diet and secretions, followed occasionally by a mild aperient, as blue mass and rhubarb, or sulphur and jalap. All drastic purgatives are, of course, inadmissible, especially such as have a tendency to act specifically upon the lower bowel. The diet must be plain, non-stimulant, and concentrated; wine, spirits, coffee, and strong tea are to be avoided. After the secretions have been duly attended to, from fifteen to twenty drops of balsam of copaiba, in the form of emulsion, may be given three times a day, combined, if necessary, with a little black drop, especially when there is a tendency to diarrhoea. In the milder varieties of the malady, I know of no internal remedy superior to this in affording relief, though of its mode of action I am unable to offer any satisfactory or even plausible explanation. With Ward's paste, as it is termed, so much extolled by some in the treatment of internal piles, my experience is very limited, but what I have seen of its effects does not justify the encomiums lavished upon it. When the patient is in need of a tonic, the most suitable remedies will be sulphate of iron and quinine, particularly if there be an anemic state of the system. Solubility of the bowels is best maintained by the daily use of the cold water enema; and evacuation is effected habitually in the recumbent posture.

Locally, the most grateful applications are cold water, in the form of baths and enemata; mildly astringent injections, as a weak solution of acetate of lead, tannin, or alum, either alone, or conjoined with an anodyne; leeching, if there be a great sense of weight and fulness in the parts; and emollient poultices, or the warm water-dressing, if the piles are protruded, inflamed, and tender. It need hardly be added that replacement of the tumors should always be promptly effected, whenever this is practicable, the efforts being facilitated, if necessary, by topical bleeding, either by scarification or leeching, and other means. An ointment composed of equal parts of sulphur and honey has long been a popular remedy, in certain sections of the country, in the treatment of internal hemorrhoids, and I am satisfied that it may occasionally be used beneficially, especially in the milder forms of the affection. When there is much spasm of the sphincters, belladonna ointment is worthy of trial, though I have rarely derived much advantage from it. In the hemorrhagic variety of piles, free use must be made of strongly astringent injections, or of powdered alum, brought, if possible, in immediate contact with the affected surface; aided, in all cases, where the bleeding is profuse, by liberal doses of opium by the mouth.

For the *radical cure* of internal piles, the proper operation is ligation, performed so as to cause prompt and effectual strangulation. The patient being under chloroform, tumor after tumor is exposed, seized

with the tenaculum, and tied with a stout, well-waxed thread of saddler's silk, secured with a double knot, with the ends cut off close to the surface. If the hemorrhoids are numerous, the largest only are selected for operation, the cure of the remainder being intrusted to the resulting inflammation, which generally affords a sufficiency of plastic matter to occlude the dilated and hypertrophied vessels. Should the cure be imperfect, the reculant tumors are similarly dealt with at a future and not distant period. Such a procedure is far better than too much interference at one time, which might not be free from risk. If the hemorrhoid has an unusually broad attachment, it may be necessary to transfix its base with a large curved needle, armed with a double ligature, each of which should then be tied around the corresponding side of the morbid growth. The operation being over, the patient takes a full anodyne, to allay pain and paralyze the bowels, and remains in bed for four or five days—the period of the detachment of the ligatures—or until the parts are sufficiently comfortable to enable him to sit up or move about the room. No aperient medicine is administered until there is a positive necessity for its use, as indicated by the patient's feelings, and then only the mildest kind. If the parts become painful after the operation, they may be fomented, poulticed, and even leeches, or cautiously scarified, especially if, as sometimes happens, they are infiltrated with sero-plastic matter. During convalescence, as well as for a long time after, the rectum should be well washed out twice a day with cold water, or some cold, demulcent fluid.

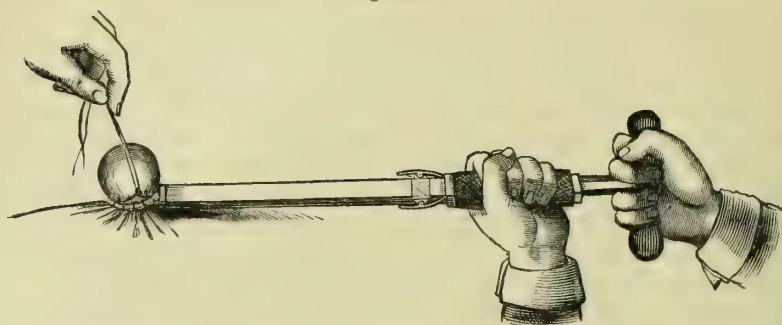
The operation now described is, in general, as simple of execution as it is certain in its results, to say nothing of its freedom from danger. Considering these circumstances, it is surprising that any surgeon should ever have thought of excision as a remedy for the radical cure of this complaint, or that it should still find a place in some of our modern treatises. Such an anomaly can be explained only on the assumption of one of two things, neither at all creditable, that is, either complete ignorance of the anatomy of this variety of piles, or the utter recklessness of the operator. To cut off an erectile tumor, composed of numerous dilated and tortuous vessels, would certainly be a most dangerous undertaking, since it could not fail to be followed by severe hemorrhage, always difficult to arrest, and sometimes fatal. Whoever has studied the memorable cases of excision of internal hemorrhoids, by Dupuytren and Cooper, will not be likely ever to repeat an operation which was attended with such disastrous results in the hands of those great men.

The *écraseur* has of late been much used for removing internal piles. It does its work very promptly and effectually, but the operation is too painful to be performed without the aid of anæsthesia. The application of the instrument is exhibited in the annexed cut (fig. 406).

I have occasionally made use of nitric acid for destroying internal piles, but with results not sufficiently gratifying to induce me to recommend its adoption as a means of radical cure, being satisfied that, while it is more difficult of application and productive of more pain and in-



Fig. 406.



flammation than the ligature, it is much less certain in its effects and more liable to be followed by relapse.

#### VARICOSE HEMORRHOIDAL VEINS.

To the subject now discussed may be added a few remarks respecting enlargement of the hemorrhoidal veins. This affection is met with chiefly in elderly persons, in association with a varicose state of the veins of the lower extremities and spermatic cord. In its worst forms it always implicates a number of hemorrhoidal veins, which, under these circumstances, are not only much dilated, but very tortuous, convoluted, and knotty, similar to what we so frequently notice in the saphenous vein and its branches. The varicosity is always most conspicuous in the ano-rectal region, but cases occur where it extends nearly as high up as the terminations of these vessels. The enlarged vessels can easily be felt on each side of the anus, both through the skin and mucous membrane, as firm, rigid cords, with, perhaps, here and there a phlebolite. Not unfrequently, indeed, they can be readily distinguished by their bluish appearance alone. When we consider that these vessels are destitute of valves, and that they are subjected to constant motion and pressure, it is not surprising that they should become diseased, and ultimately varicose.

Varicose enlargement of the hemorrhoidal veins should not be confounded with hemorrhoidal tumors, which it so often accompanies, as it is very distinct from that affection. It is characterized by a sensation of weight, and fulness in the ano-pelvic region, by vague, uneasy feelings in the perineum, sacrum, and loins, and by smarting, burning, or stinging pains during defecation, and for a short time after. On inserting the forefinger into the bowel and applying the thumb to the surface of the anus, the affected vessels can easily be felt like so many separate cords, or like scattered earth worms. The general health is not necessarily impaired, though it is often deranged; more frequently, perhaps, as a cause than as an effect of the complaint.

I imagine few surgeons would be found bold enough to attempt the obliteration of these vessels with the ligature, and yet such an operation might not, perhaps, involve any greater risk than the tying of a number of large hemorrhoidal tumors. When the disease is productive

of constant suffering, linear eschars might be made over a few of the largest veins by means of the Vienna paste, a procedure which I should regard as perfectly safe, from what experience we have of this treatment in varicose enlargement of the veins of the leg. Much may be done in such a case, by way of palliation, by attention to the bowels and diet, by an avoidance of the exciting causes of the disease, by cold enemas, and by frequent ablutions with soap and water.

#### ANAL TUMORS.

Pendulous tumors, frequently the result of external hemorrhoids, form around the anus, just at its verge, or at the junction of the muco-cutaneous surfaces. They are generally soft, irregularly globular, or pear-like in shape, smooth, or rough, and of a solid, fibroid structure. Occasionally, however, they are composed of a spongy, erectile substance, not unlike that of the cavernous body of the penis, and, therefore, liable to bleed after excision. I believe that this form of tumor is more common than has been supposed, inasmuch as a number of well marked examples of it have fallen under my observation. Its vessels are apparently merely prolongations of the smaller hemorrhoidal veins, in a state of dilatation and varicosity, and closely invested by rather dense cellular substance. In size, such an excrescence may equal the end of the little finger; its color usually resembles that of the skin, or the muco-cutaneous tissues, to which it is attached; it is sometimes solitary, but more frequently multiple. I have seen these growths so numerous as to form a complete chaplet around the anus, causing much trouble in walking, and much annoyance in defecation. Venereal warts and tubercles also occur in this situation, both in children and in adults, the former as an effect of local, the latter of constitutional, contamination.

If troublesome, these circum-anal growths may be removed with the knife, or snipped off with the scissors. The erectile tumor should, however, always be tied, on account of its liability to hemorrhage; or, if excision has been practised, and bleeding ensue, ligation must follow the knife, the edges of the wound being raised with the tenaculum, and firmly tied. In a case of this kind, a patient of Dr. O'Reilly, on whom I operated before the medical class of the University of Louisville in 1854, I was called an hour after I had excised five or six of these excrescences to the bedside of the patient, who had been bleeding quite profusely, and where I was finally compelled, after unavailing efforts with other means, to adopt this measure, using both the twisted and the interrupted suture. Venereal warts may be excised, or destroyed with chromic acid, dry lint being interposed in the intervals of the application. Syphilitic tubercles require the ordinary topical and constitutional treatment.

#### POLYPS OF THE RECTUM.

Polyps of the rectum are, on the whole, uncommon; certainly much more so than in the nose and in most of the other mucous outlets.

Children under twelve years of age are most prone to them, but they are also met with in adults, and sometimes, though very rarely, in elderly persons. In regard to their structure, they partake of the same character as polyps of the nose and uterus, being, in this respect, divisible into three classes, the gelatinoid, fibrous, and cellulo-vascular. As to the relative frequency of these varieties, and the circumstances which determine their development, we have no definite knowledge. They are all of tardy growth, free from malignancy, prone to bleed, and liable to protrude during defecation. In their volume they vary from that of a filbert to that of a hen's egg, their shape being, for the most part, somewhat pyriform, ovoidal, or globular, while their attachment is usually effected through the medium of a slender pedicle, which is sometimes of extraordinary length. In the case of an Irishman, on whom I operated, some years ago, the polyp, which was of the cellulo-vascular variety, and not larger than an ordinary marble, had a pedicle upwards of four inches in length, and scarcely as thick as an ordinary stalk of wheat. Occasionally, on the other hand, the pedicle is very short, not exceeding a few lines. Authors speak of a sarcomatous polyp of the rectum, with a tendency ultimately to take on malignant action; of this form of the disease I have never seen an instance, and am certain that it must be very rare. The distance at which these morbid growths are situated from the anus varies from two to six inches, the average being about three inches or three inches and a half. It is seldom that they are multiple. The adjoining cuts afford a good idea of the external and internal appearances of the cellulo-vascular polyp. Fig. 407, shows its shape, which, in this case was reniform, and fig. 408 the internal structure.

Fig. 407.

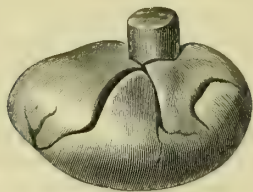
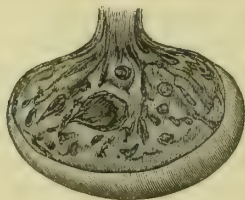


Fig. 408.



Persons who labor under rectal polyps generally experience a sense of weight and uneasiness in the lower part of the pelvis, with a frequent desire to relieve themselves, and more or less straining during defecation. The feces are usually somewhat flattened, and there is almost always an abundant discharge of mucus, of a glairy, reddish appearance, not unlike thin currant jelly. When the tumor is situated near the anus, or when it has an uncommonly long pedicle, it is apt to protrude during the evacuation of the bowels, and to be compressed by the sphincter muscles. At such times, too, it is liable to bleed, though this it also sometimes does when it remains undisturbed, especially if it be very vascular. In children, indeed, the loss of blood from this source is occasionally quite considerable. Cases have been known where a tumor of this kind has been detached by the forcible contrac-



tion of the bowel, or where it has sloughed off from the pressure exerted upon it by the sphincter muscles. The general health is usually unimpaired.

A polyp of the rectum is usually easy of recognition. Its tardy growth, its floating nature, its occasional protrusion at the anus, and the functional disturbance which it causes in the bowel, are generally sufficiently characteristic. Where any doubt exists, a thorough digital examination will promptly dispel it. The affections which are most liable to be mistaken for it are stricture, hemorrhoids, and prolapse.

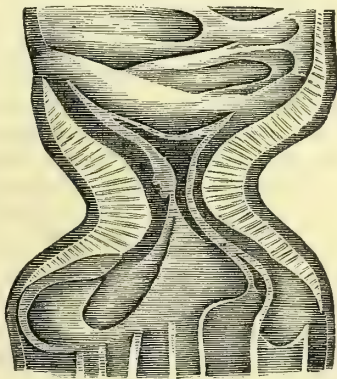
The only *remedy* for this disease is removal by ligature or torsion. If the tumor be small, and situated just above the verge of the anus, it may be seized with a pair of long, slender forceps, and twisted upon its axis until it drops off, the procedure being conducted in the same manner as in the removal of a nasal polyp; but, under opposite circumstances, or when the growth is very vascular, the safer plan is to tie it, and let it slough off. Finally, where this is impracticable on account of the great height of the tumor, it may readily be destroyed by crushing, or strangulation, by means of the *écraseur*. The objection to excision is its liability to hemorrhage, which has sometimes been so great as to endanger life, and which it might be difficult to arrest, especially when the tumor is seated at a considerable distance from the anus.

#### STRICTURE OF THE RECTUM AND ANUS.

I cannot suppose that simple stricture of the rectum, such as we observe in the urethra and other mucous canals, is as common a disease as is generally supposed. My opinion is that it is one of those affections which are much more frequently described than observed. I have certainly very rarely met with it, nearly all the cases of stricture of the lower bowel that have come under my notice having been of a carcinomatous nature.

The most common *seat* of organic stricture of the rectum is from two and a half to three inches and a half above the verge of the anus, or easily within reach of the index-finger. Affecting generally only a portion of the tube, it sometimes reaches round its entire circumference, its vertical extent being seldom less than twelve, fifteen, or eighteen lines (fig. 409). The degree of its encroachment upon the caliber of the gut varies from the slightest diminution to almost complete obliteration, the orifice of the stricture being sometimes scarcely large enough to admit of the passage of a goose-quill. The immediate cause of the disease is an effusion of plastic matter into the submucous cellular tissue, the other tunics retaining their integrity, or, at all events, experiencing only a slight change of consistence.

Fig. 409.



This substance soon becomes organized, and gradually assumes a dense, fibrous character, creaking under the knife, and exhibiting a bluish-white appearance. The tendency of this substance is to extend inwards towards the caliber of the tube, so as to encroach upon the mucous membrane, which, although it often retains its integrity for a long time, finally yields to the diseased action, becoming adherent to the subjacent parts, and at length ulcerated at different points; the period at which this occurs, from the commencement of the stricture, varying from several months to as many years.

It is not always, or even generally, that we can trace this disease to any particular *cause*. In the very few cases that I have met with, I could obtain no clue as to its origin. It is not unlikely that it may be produced by an ulcer, or, rather, by the contraction consequent upon the cicatrization of an ulcer; by inflammation arising from the lodgment of a foreign body; by the use of drastic purgatives and irritating injections; and, finally, by the application of the actual cautery, the different acids, or hot water. The disease is most common in adults; and a belief prevails, whether well founded or not I am unable to say, that women are oftener affected with it than men.

Organic stricture of the rectum manifests itself by the usual *symptoms* of alvine obstruction, attended with a frequent desire to go to stool, great straining and bearing-down while at stool, and a flattened, ribbon-like shape of the excrement. As the contraction progresses, the suffering increases; the bowels are habitually distended with gas and feces; colicky pains are often present; the appetite and digestion are impaired; the countenance becomes wan and sallow; the mind is despondent and filled with evil forebodings; the flesh wastes; the strength declines; and the surface is easily impressed by atmospheric vicissitudes. Finally, ulceration sets in, greatly aggravating the local and constitutional distress, and death, at length, probably after years of suffering, closes the scene.

This disease is liable to be *confounded* with carcinomatous degeneration of the bowel, ulceration, and internal hemorrhoids, from which, however, it can, in general, be easily distinguished by its history, and by a thorough digital and specular exploration. Cancer of the gut is usually rapid in its march, and impresses itself at an early period, in an unmistakable manner, upon the constitution.

The *treatment* is conducted upon the same principles as in stricture of the urethra, an attempt being made to induce the absorbents to remove the plastic matter, which is the cause of the obstruction, by the use of bougies of successively increasing diameters. If much irritation, with inflammatory tendency, exist, a few days are spent in the employment of soothing measures, in order to render the parts more tolerant of the requisite manipulation. A small sized bougie, either of gum-elastic, pewter, or sole-leather, well oiled and warmed, is carefully introduced into the stricture, where it is retained from two to five minutes, when it is withdrawn, to be again inserted at the end of forty-eight hours, to remain a similar, longer, or shorter time, according to the effect produced, it being constantly borne in mind that the object is not to excite, but to reduce, action, and to stimulate gently the

absorbent vessels. After the first week, a larger instrument is used, now, perhaps, once a day, then a still larger one, and so on, until the tube has been restored to its original capacity; a circumstance, however, rarely to be expected in any case, for there is no disease more likely to prove troublesome and rebellious. When the more common bougies are not at hand, or are not borne, use may be made of a wax or spermaceti candle. The intervals of the treatment are occupied in attention to diet, rest, the use of cooling enemata, and various other means calculated to prevent capillary excitement in the part. When the stricture is very firm, and almost impermeable, it has been proposed to notch it at four opposite points, to facilitate the passage of fecal matter, and of the bougie; and such a procedure is sufficiently plausible to justify its adoption, notwithstanding what has been alleged to the contrary. The surgeon often incises strictures of the urethra, and why should he not apply the same principle of treatment to strictures of the rectum and anus? In contraction of the latter, I have had a number of instances where the operation was followed by great, though not permanent, relief. When the case is utterly hopeless, life may, perhaps, be prolonged by the establishment of an artificial anus in the lumbar region, provided the patient is willing to submit to so disgusting a procedure.

#### CANCER OF THE ANUS AND RECTUM.

Cancer of the anus and rectum may exist as a primary disease, or as a propagation from the adjacent parts, as the uterus and vagina, or the pelvic lymphatic ganglions. The most common form in which it appears is that of scirrhus, occurring either as an infiltration in the connecting cellular substance, or as a tumor of variable size and shape, and of the consistence which ordinarily appertains to this deposit in other situations. Of encephaloid and colloid of the ano-rectal region very little is known, as they have been noticed only in a few instances, the particulars of which have, besides, not been well reported. The same remark is strictly applicable to melanosis, of which I have myself witnessed but one example. The patient was a man, fifty-eight years old, who labored under the same disease in nearly all the principal organs of the body, and who died, after an illness of upwards of twelve months, in a state of the utmost emaciation. His principal symptoms, as it respected the anus and bowel, were, frequent discharges of mucopurulent matter, often streaked with blood, diarrhœa, griping, and tenesmus, flatulence, and, at length, total loss of power in the sphincter muscles. Several black tumors, hard, irregular in shape, and about the size of small grapes, existed at the verge of the anus; and the finger, carried into the rectum, readily came in contact with a hard cancerous mass, which, on dissection, was found to consist of a mixture of scirrhus and melanosis. The prostate gland was somewhat enlarged, and the bladder had evinced great impatience of its contents during the last five or six months.

Scirrhus of the ano-rectal region is most common in elderly and old subjects, but I have observed several instances in young adults, and a



case has been reported of ulcerated cancer of the rectum in a child aged twelve years. One of the very worst examples of carcinoma of the anus, as it respected the rapidity and extent of the malady, that I have ever seen, was that of a man scarcely twenty-two years old. When I first saw him the disease had already attained an extraordinary development, attended with great contraction of the anal orifice; and death took place in less than eighteen months from its first manifestation. My opinion is that scirrhus in both these localities is much more common in young persons than is generally supposed. It is not known what influence, if any, sex exerts upon the production of primary cancer here; the prevalent belief is that it is most frequent in the female, but this is opposed to my experience, which has supplied me with a greater number of cases in the male, though it is not in my power to give the precise proportion. Secondary cancer, on the contrary, is most frequent in women, owing to their great liability to carcinoma of the uterus, and the remarkable facility with which the malady, when it occurs in this situation, extends to the vagina, anus, and rectum.

The ordinary *site* of scirrhus of the rectum is at a height of from two and a half to three inches from the verge of the anus, or at a point that is readily accessible by the finger. Examples, however, occur where it is located further up, or lower down. In the latter case, the malady sometimes co-exists with scirrhus of the anus. The most common form in which the heterologous matter exhibits itself in the rectum is the tuberoid, the nodules varying in size from that of a pea up to that of a pullet's egg, and in consistence from that of hard cheese to that of fibro-cartilage, their color being usually of a pale straw or light drab. When the deposit is large, it may involve the whole circumference of the cylinder, and often does so during its progress. It is generally supposed that the posterior portion of the tube is more prone to suffer than the anterior or lateral, but this is very questionable. When the morbid substance occurs as an infiltration in the wall of the rectum, it always exists most conspicuously in the submucous cellular tissue, which has a dense, gristly appearance, intersected by bluish bands, which give the parts an areolar structure, similar to that of cancer of the stomach and œsophagus. When the disease is situated at the anus, it always observes the tuberiform character, and is generally attended with extraordinary hardness. In whatever form it occurs, or whichever of these parts it affects, it is sure, in time, to encroach very seriously upon the caliber of the tube, and finally even to lead to such a degree of occlusion as to prevent effectually the discharge of fecal matter. I have seen quite a number where the opening was hardly large enough to admit the point of the little finger. The tube above the seat of the obstruction may retain its natural caliber, or be somewhat dilated. The period which elapses from the first appearance of the disease to its ultimate termination varies, on an average, from one to two years. As a general rule, scirrhus of the rectum will be found to destroy life sooner, by several months, than scirrhus of the anus.

The *symptoms* of scirrhus of the ano-rectal region are, at first, often

obscure, being such, mainly, as attend some of the other affections already described. As it progresses, however, it acts not only obstructingly but gives rise to sharp, lancinating pains, extending into the thighs, nates, perineum, and sacrum, and attended with a sense of weight and pressure low down in the pelvis. The process of defecation becomes gradually impeded; the patient is obliged to strain a great deal at stool, the calls to which are often preternaturally frequent; and the feces are passed in a flattened, ribbon-like form, instead of being cylindrical, as in the natural state. Very often the only thing that is evacuated is a thick, glairy mucus, perhaps streaked with blood, or blood and pus, which are liable to be poured out in large quantity, and to escape almost incessantly, thus compelling the sufferer to wear a cloth to keep himself clean and comfortable. The bladder is usually rendered irritable, even at an early period, especially when the disease is located at the anterior wall of the rectum, or the forepart of the anus; the bowels are habitually distended with feces and gas; the general health gradually fails, the emaciation steadily progresses; and the countenance assumes the peculiar sallow aspect, so characteristic of the cancerous cachexia.

Cancer of the rectum and anus can hardly be *confounded*, after it has made some progress, with any other disease. The peculiar character of the pain, the indurated condition of the parts, the gradual contraction of the caliber of the tube, the difficulty in defecation, the abundant mucus, or muco-puriform secretion, and its involuntary escape at the anus, the constant distension of the bowels, the flattened character of the feces, and the difficulty of introducing fluids or solids into the rectum, or through the anus, together with the progressive emaciation and failure of the general health, are always unmistakable evidences of the nature of the malady. In cancer, the rectum never descends as it does in prolapse and in hemorrhoids; no openings exist around the anus, as in fistule; and there is not that severe spasmodic pain during defecation and for some time after, that attends fissure of the anus. Besides, in all these affections, which are more liable to simulate carcinoma than any others, a digital examination can usually be made with comparative ease, on account of the more yielding nature of the parts. Polypous growths, enlargement of the prostate gland, a retroverted uterus, and the presence of a pessary, are always easily detected by the finger.

The *treatment* of this affection must be conducted upon the same principles as that of cancer in other situations. Palliation being all that is to be hoped for in any case, our measures must be chiefly of a soothing and detergent character, consisting of enemata of tepid water, or of tepid water and olive oil, to insure cleanliness and patency of the lower bowel, of frequent ablutions when the disease is external, or where there is much discharge, and of anodyne suppositories, or opiate injections, to allay pain and spasm. When there is much heat in the parts, attended with a sense of weight, leeches and the warm water-dressing, simple or medicated, will prove beneficial. The bowels are evacuated in the recumbent position; fœtor is allayed by the chlorides; all sexual excitement is avoided; and the general health is carefully

watched and superintended, the food being non-stimulant, concentrated, and nutritious. In the latter stages, tonics and alcoholic drinks will be necessary, with the internal use of morphia, soda, and carminatives, to calm and soothe the stomach and bowels.

The employment of the *bougie* in the treatment of cancerous affections of the ano-rectal region is of doubtful utility, if not decidedly prejudicial. During their earlier stages, and especially in cases attended with inordinate coarctation, while ulceration is not yet impending, the cautious passage of such an instrument, every third or fourth day, may be productive of some benefit in widening the tube, and thus facilitating the evacuation of its contents; but beyond this no advantage is to be anticipated, while its more frequent use could hardly fail to be a source of irritation and mischief. A gum-elastic bougie, well oiled, and retained for five or ten minutes within the constricted part, would be the most eligible instrument.

*Excision* promises no benefit in this disease, save temporary relief from pain and fecal obstruction. When the anus is involved, the operation must, of course, include the sphincter muscles, thereby depriving the patient of the power of controlling his passages, and the same result would be pretty sure to follow the excision of a portion of the rectum, to say nothing, in the latter case, of the immediate risk to life from hemorrhage, peritonitis, and phlebitis. As a temporary expedient, designed to prolong life, the rectum may occasionally be slightly notched at the contracted part, a tent being left in the bottom of the fissure to insure patency. The bleeding, consequent upon the operation, will allay inflammation and suffering. For a similar reason, any obstructing nodules at the verge of, or within, the anus may be dissected off, or destroyed with the actual cautery.

#### NEURALGIA OF THE ANUS AND RECTUM.

Neuralgia of the anus and rectum is most common in persons of a nervous, irritable temperament, from the age of twenty-five to fifty; it usually co-exists, or alternates, with attacks of a similar kind in other parts of the body, particularly the face, stomach, testicle, mamma, and bladder. It is characterized by paroxysms of pain, which is generally described as of a tearing, burning, or lancinating nature, situated at the extremity of the lower bowel, from which it is apt to extend to the sacrum, loins, pubes, and genito-urinary organs. Defecation is exquisitely painful, and the urine is discharged in jets or drops, attended with a scalding sensation. The attacks commonly subside in from five to ten hours, to recur with tolerable regularity about the same period the next day, though sometimes not until the second or third. During the intermissions, the patient is, in great degree, free from pain, and passes his feces and urine without difficulty. The affection often continues for years, and the paroxysms are then apt to be more frequent and irregular, recurring perhaps every few hours.

The causes of neuralgia are various. We often see it arise from disease of the ano-rectal region, or from the pressure exerted upon the lower bowel by an enlarged prostate or a retroverted womb. In hemor-



rhoids, stricture, fissure, and other maladies, the pain frequently derives its chief severity from its neuralgic character. Sometimes the disease is of a miasmatic origin, especially in persons living in malarious regions, infested with intermittent fever. When this is the case, it generally recurs in regular paroxysms, once every twenty-four hours or every third day. Again, cases occur in which it appears to be caused simply by derangement of the digestive apparatus, as dyspepsia, constipation, worms, or disordered biliary secretion. We frequently, as was intimated before, see neuralgia of the anus and rectum alternate with neuralgia of other parts. I recollect several cases where it was thus associated with neuralgia of the chest, face, and testes. In the female, the disease is sometimes connected with dysmenorrhœa.

As this disease never proves fatal, it is impossible to affirm what its real pathology is. In our examinations of such cases, we occasionally detect, a short distance above the anus, or even within the anus itself, a small spot so exquisitely sensitive as to cause the most excruciating suffering, and this, perhaps, even where there is no inflammatory redness, ulceration, or appreciable disease of any kind.

Neuralgia of the rectum must be treated according to the nature of its exciting cause, which should always, if possible, be sought out, and removed. Thus, if there be hemorrhoids, stricture, or ulceration, the practitioner will seldom be able to make any decided impression upon the case until these affections are disposed of. As there is almost always manifest derangement of the digestive organs, either as a cause or an effect, a mild, but systematic course of purgation constitutes, in general, a primary object in the treatment. On no account should the rectum be allowed to become distended with fecal matter, which, as I am well assured by my own experience, may bring on and keep up neuralgia of this tube in its most violent forms. After due attention has been bestowed upon the secretions of the stomach, liver, and bowels, the most appropriate remedies will be quinine, iron, arsenic, and strychnine, in quantities suited to the age, habits, and temperament of the individual. When the paroxysms observe a regular periodicity, the quinine should be given in large doses, as ten grains, combined with one-third of a grain of morphia, every six, nine, or twelve hours, until the disease is broken up. During the attacks, anodyne enemata, suppositories, and fomentations will be beneficial. Despite, however, all these and other means, the malady often continues, with little mitigation, for years, baffling the skill of the practitioner, and compelling the patient to eke out a miserable existence.

#### PRURITUS OF THE ANUS AND NATES.

The skin at and immediately around the anus is liable to be the seat of pruritus, or a peculiar form of itching, frequently as obstinate as it is annoying. The affection is most common in middle-aged and elderly subjects, particularly such as are of a weakly constitution, or inclined to dyspepsia and irregularity of the bowels. I have, however, repeatedly witnessed it in persons apparently in the most perfect health. Occasionally it occurs during pregnancy, coming on soon

after conception, and going off gradually after delivery. Women who have recently ceased to menstruate are also liable to it. Persons of a light, delicate skin, florid complexion, and red hair, are particularly prone to the complaint; but from what I have seen of it, I am inclined to believe that no physical organization, temperament, or occupation, is entirely exempt from it.

The disease consists essentially in an eczematous condition of the skin, which is covered with exceedingly minute vesicles, scarcely as large as the smallest pin head, and occupied by a thin, watery fluid. When these vesicles break, they leave little sores, discharging an irritating sanies, which, as it dries, sometimes forms little incrustations upon the surface. Instead of vesicles, small cracks, or chaps, occasionally appear upon the skin around the anus, similar to those which are so often met with on the lips and nose. The affected surface is generally very limited, perhaps not exceeding in size a quarter of a dollar. From the constant rubbing to which it is subjected, it is liable, in time, to become indurated, stiff, thickened, and furrowed; from the same cause, or even from the mere friction of the buttocks in locomotion, it is apt to become inflamed and painful, producing difficulty in walking, riding, and even in sitting. I have known the pain thus occasioned to extend sometimes down along the corresponding limb as far nearly as the heel. In bad cases, the disease may spread over a considerable surface, attacking, perhaps, at the same time, the buttock, the perineum, the scrotum, and even the thigh. More remote parts, too, may suffer, as the face, neck, nose, and eyelids.

The *duration* of the pruritus is extremely variable, lasting sometimes only a few days or weeks, and at other times as many months. Once fairly rooted, it may continue, despite our remedies, for an indefinite period. In one case I knew it to continue, with an occasional intermission, for sixteen years, and in another for upwards of twenty, before it finally disappeared. It is commonly worse in cold than in warm weather, although, in this respect, there is much individual difference. It is also usually more troublesome at night than in the day, the suffering being often so severe as to prevent sleep for hours together; or, if the patient goes to sleep, he soon wakes himself up by scratching and rubbing the part. Sometimes the disease unexpectedly disappears, the person imagining himself well, when all of a sudden, either without any obvious cause, or from the slightest irregularity of diet, fatigue, loss of rest, or exposure to heat, it returns with all its former severity.

The *cause* of pruritus is often difficult of detection. The complaint is unquestionably, in many cases, associated with disorder of the anus or ano-rectal region, as hemorrhoids, stricture, sacciform disease, and the presence of ascarides; but whether it is produced by it is a point which has not been determined. We certainly see cases every day of these affections without the occurrence of pruritus. In most of the instances of the latter complaint that have come under my observation I have been disposed to ascribe its origin to some derangement of the digestive apparatus, as dyspepsia and constipation, attended with an irritable state of the constitution, and to regard it as a kind of safety-

valve, designed to protect other and more important parts from disease.

In the *treatment* of this affection a primary object should be to inquire into the condition of the anus and digestive organs, with a view to the rectification of any disorder that may be supposed to be capable of exerting an influence in producing and perpetuating it. If the general health is impaired, no improvement will be likely to take place in the local disease until this has been restored. In some cases tonics, as iron and quinine, may be demanded, while in others directly opposite measures may be indicated, depending upon the state of the system. In almost every instance, a regular systematic course of purgation, consisting of the compound calomel pill, along with iodide of potassium and sarsaparilla, or, in plethoric subjects, the antimonial and saline mixture, in small doses, will be serviceable. The diet must always be bland and unirritant. The most useful topical remedies are the black and yellow wash, solutions of acetate of lead and laudanum, Turner's cerate, and tar ointment, all properly diluted. Cold ablutions with castile soap afford great relief, and are indispensable to the patient's comfort. In obstinate cases, resisting the ordinary remedies, slight ptyalism, maintained for several weeks, should be tried.

#### MALFORMATIONS.

The anus and rectum are liable to malformations, of which the most important are, an imperforate state of the former, and the termination of the latter in a cul-de-sac, or its communication with the urethra, the bladder, or the vagina. Instances have been observed, although very rarely, in which the rectum opened in the sacral region, at the umbilicus, on the side just below the scapula, and on the face, the congenital vice having, in each case, been conjoined with other aberrations of structure. In another class of cases, also exceedingly rare, it terminates in the perineum, in a canal common to it, and to the genito-urinary organs, constituting thus a species of cloaca, similar to that of a bird. On the other hand, the rectum and anus being perfectly natural, the former may receive the ureters, or even the vagina, thus conducting off both the urine and menstrual fluid in this direction. Such malformations are obviously more interesting in a physiologico-pathological point of view than in a surgical one, inasmuch as they are always necessarily irremediable.

The most simple, as well as most frequent, variety of imperforate *anus*, is where the occlusion is effected by a continuation of the common integuments, or a cutaneo-mucous lamina, from one side to the other, the junction being established imperceptibly at the median line. The covering thus formed is generally so thin and translucent as to permit the meconium to be distinguished through it, and to bulge out whenever the child makes an effort at defecation, the tumor receding under the finger, but immediately reappearing when the pressure is removed. More rarely the closure is established by a cellulo-fibrous structure, from one to three lines in depth, dense, hard, and inelastic, and accompanied by more or less contraction and puckering of the



circumjacent parts. In either case, but especially in the latter, there is usually an imperfect development of the sphincter muscles; and hence, although the defect may be remedied by operation, the child cannot, for a long time, exercise much control over its alvine evacuations. Sometimes, again, an anus exists, but only in a rudimentary state, being so small and tight as to afford a very inadequate outlet for the contents of the bowels.

When the anus is closed by a covering of the common skin, a crucial incision will generally suffice to afford relief, the angles of the wound being snipped off, and the skin and mucous membrane tacked together by several points of suture. In the second form of the occlusion, the parts must be divided more thoroughly, readhesion being prevented by the tent, and the requisite size given by the daily use of the bougie. When the anus is merely contracted, the frequent insertion of the mother's finger will be the best instrument for dilating it; this failing, the margins are notched on each side with a probe pointed bistoury.

Occlusion of the *rectum* is effected either by a species of hymen, situated from six to twelve lines above the anus, or by a cellulo-fibrous substance, of variable length and thickness. In the former case there is always a well-formed anus, whereas in the latter the anus is either completely wanting, or present only in a rudimentary state. The ano-rectal septum, as it may be termed, is composed of a fold of mucous membrane, of a circular shape, and is always easily detected with the probe or finger. During the cries of the child, and especially during straining, in attempts at defecation, it is sometimes forced down almost within reach of the eye, forming a dusky, fluctuating protrusion. In the second variety of occlusion, the obstruction is caused by cellulo-fibrous matter, which often extends to the height of an inch and even an inch and a half, constituting thus a most formidable barrier. Finally, the rectum is sometimes entirely absent, the intestinal tube terminating in a cul-de-sac, or opening, as previously stated, at some unnatural point. However this may be, the pelvis is generally abnormally small, and there is no trace whatever of an anus. In rare cases, the absent canal is represented by a fibro-ligamentous cord, attached to the colon, and descending along the sacrum towards the neck of the bladder, where it is lost in the cellular substance.

The more simple form of occlusion of the rectum admits of relief by a very simple procedure, consisting in a crucial division of the septum, with or without removal of the angles of the wound, and the occasional introduction of the mother's finger, which is, in all such cases, the best tent. In the other variety, a severe operation is required, and that, too, in many cases, without any certainty of ultimate success. The child being held upon the lap of an assistant, the breech is exposed as in lithotomy, and an incision made through the posterior part of the raphe of the perineum, the knife being carried up in the direction of the curve of the sacrum to the distance, if necessary, of from two to three inches, the left index-finger serving as a guide to the instrument. The operation is done slowly and cautiously, care being taken to avoid the bladder and urethra in front, the great pelvic vessels at the sides, and the sacrum behind, lest, as it respects the latter, the knife pass

behind the tube of which it is in search. Patency and dilatation are promoted by tents and bougies, cautiously used for a long time afterwards, and aided, if requisite, by an occasional touch of the bistoury, to counteract the tendency to closure, which is always great in such cases.

An operation similar to the one just described may be performed when the rectum is absent, although with hardly any possibility of a successful issue; for, even supposing that the canal could be reached, the child would be likely to perish from peritoneal inflammation, induced either by the incision of the intestine, or by the extravasation of fecal matter. Still, it is justifiable because there is no other chance of relief, except by the establishment of an artificial anus in the lumbar region; a procedure not only fraught with danger, but, in all respects, so undesirable as hardly to be thought of by any right thinking surgeon; for life, under such circumstances, would certainly not be worth having.

The rectum, instead of terminating at the anus, occasionally, though very rarely, opens by a narrow canal into the *urinary* passages, generally at the posterior part of the urethra, or at the *bas-fond* of the bladder, a short distance below the insertion of the ureter; the former mode of communication being the more frequent. The malformation is almost peculiar to males, and generally proves fatal within a few days after birth, on account of the small size of the recto-vesical outlet not allowing of a sufficiently free discharge of fecal matter. To this rule, however, occasionally an exception occurs; thus, in a case which I attended with Dr. Kempf, and in which I made a very deep incision without reaching the bowel, the child survived six weeks, passing daily a little fecal matter by the urethra. An uncle of the child had lived in a similar condition for upwards of thirty years. Such a vice of formation is generally beyond the surgeon's skill; still, when the danger is imminent, an attempt should be made to reach the bowel by cutting along the sacrum, a staff being inserted, if possible, into the recto-vesical orifice as a guide to the instrument.

When the rectum terminates in the *vagina*, the opening is usually situated low down, and is a good deal larger than when the bowel communicates with the urinary passages, though seldom equal to nature's wants. On this account, and also for the purpose of freeing the vagina, an attempt should be made to establish an opening at the usual site of the anus. The operation is very simple, the knife being carried from before backwards, in the direction of the *raphé* of the perineum. The skin and mucous membrane may afterwards be tacked together, and reclosure prevented by the finger and bougie.

#### FORMATION OF AN ARTIFICIAL ANUS.

The establishment of an artificial anus is generally supposed to be indicated when life is placed in imminent jeopardy in consequence of the existence of some insurmountable mechanical obstacle to the evacuation of the feces. The operation, under such circumstances, is considered not only as justifiable, but as imperatively called

for by every principle of humanity and sound judgment. That this is the universal opinion upon the subject, is proved by the fact that numerous attempts have been made to devise a suitable operation for the purpose, and that every modern work on surgery, in whatever language it may be written, invariably refers to the procedure in terms of approval, if not of positive commendation. When we consider the object for which an artificial anus is usually established, we are struck with astonishment that this should be the case; that any one, possessed of the proper feelings of humanity, should seriously advocate a procedure so fraught with danger, and followed, if successful, by such disgusting consequences. I cannot, I must confess, appreciate the benevolence which prompts a surgeon to form an artificial outlet for the discharge of the feces in a case of imperforate anus in a child, in whom the rectum is either completely absent, or terminates blindly several inches above its normal situation; or in a case of scirrhus of the bowel in an adult, in whom, from the very nature of the disease, life cannot possibly be prolonged beyond a few brief weeks or months at farthest. Let the surgeon, if he be a parent, ask himself the question, whether he would not rather see his child die without an attempt at relief than to place it in a condition that would only render it an object of disgust to itself, and of loathing to every one around; or, if he be a husband, whether it would not be more in consonance with the dictates of humanity to abandon his wife to her fate than to undertake to eke out for her a miserable existence by such a pitiful and revolting an expedient? I have performed the operation but once, and I am sure nothing could ever induce me to attempt it again. While it is impossible, I conceive, to bestow too much praise upon those who first conceived and executed the design of affording aid to this unfortunate class of sufferers, it is evident from the statistics which have been published upon the subject, and to which special reference will be made by and by, that the operation is founded upon misdirected sympathy, and that it ought to be discarded as among the obsolete devices of surgery. I shall, nevertheless, as this work is intended to exhibit an outline of the existing state of the science upon every topic of which it treats, append a concise account of the more important procedures that have been suggested for the accomplishment of the object under consideration.

Littré, as early as 1710, proposed, in a case of imperforate anus, to reach the bowel by an incision through the left lumbar region, the design being to open the sigmoid flexure of the colon, and then to secure the orifice in the tube to the wound in the walls of the abdomen by means of a thread passed through the mesentery. The first attempt, however, to carry out this suggestion, or, more correctly speaking, the principle upon which it was founded, was made by Pillore, of Rouen, in 1776, in the case of a man affected with a carcinomatous tumor of the rectum, completely obstructing the evacuation of the feces. The artificial anus was made in the cæcum, and the patient survived twenty-eight days, the immediate cause of death being violent inflammation of the jejunum, occasioned by the accumulation of an immense quantity of metallic mercury, taken previously



to the operation. The first operation of this kind that was ever performed for the relief of imperforation of the anus, was executed by Dubois, in 1783, but it was unsuccessful, the child dying on the tenth day. Duret, a surgeon of Brest, in 1793, was more fortunate. He opened the sigmoid flexure of the colon, of a child two days old, who not only survived the immediate effects of the operation, but, when last heard from, had attained the age of forty-two years. Four years after this, Fine, of Geneva, made an artificial anus in the arch of the colon, by cutting through the umbilical region of a woman, aged sixty-three, in a case of constipation from scirrhus of the upper part of the rectum. She lived upwards of three months and a half, when she perished from the effects of the disease.

Two distinct processes have been employed for establishing an artificial anus; in one, usually known as that of Littré, the bowel is entered through the peritoneum, both parietal and visceral; and in the other on the outside of that membrane, in the space left uncovered by the fold of the meso-colon. The latter was originally described by Callisen, of Copenhagen, in 1796, in his *System of Surgery*, but whether the suggestion was his own or not is not known. However this may be, the operation was almost universally condemned by the profession, on account of its supposed difficulties, until 1835, when it was revived, modified, and improved by Mons. Amussat, of Paris.

The operation of Amussat, the only one which I shall formally describe, consists in perforating the bowel through the iliac fossa, midway between the last rib and the crest of the ilium, the incision commencing at the edge of the sacro-lumbar and long dorsal muscles, and extending horizontally forward for about four inches. The skin and subcutaneous cellular tissue having been divided, the muscles and aponeuroses are successively penetrated to the full extent of the external wound, constant use being made of the grooved director, especially as we approach the more deep-seated structures. In very corpulent subjects, it is sometimes necessary, in order to obtain a sufficiency of room, to incise the different muscular layers perpendicularly, so as to give the wound somewhat of a crucial shape, but, in general, this may be obviated by drawing the parts forcibly asunder with stout retractors. The muscles involved in the operation are the broad dorsal, external oblique, internal oblique, and transverse abdominal, together with a small portion of the square lumbar, though this occasionally entirely escapes. The bottom of the wound is formed by a large quantity of cellulo-adipose substance, especially conspicuous in fat subjects; this must next be carefully divided with the finger, or handle of the scalpel, and the colon sought for as it lies in the iliac fossa, a point almost midway between the anterior and posterior spinous processes of the ilium, but a little nearer to the former than the latter. The colon will generally be easily recognized by its greenish hue, by its fixedness, and by its distended condition, the latter causing the small intestine to be pushed out of the way. As soon as the cellular connections at the bottom of the wound have been severed, the bowel will project freely forward, and is then to be pierced with a tenaculum, in order to prevent it from slipping back after it has been incised.

A transverse opening is now to be made into the most prominent portion of the gut, about two inches in length, and its edges tacked to those in the external wound by at least six sutures, two corresponding with each side, and one with each angle. The whole procedure of incising and stitching the bowel should be conducted with the greatest possible care, lest fecal extravasation occur; a circumstance which might be productive of severe inflammation. Despite, however, of this precaution, it generally happens that a portion of the contents of the tube escapes as soon as penetration has been effected. Thorough clearance having been established, the patient is replaced in bed, and the part covered with the tepid water-dressing.

Very little bleeding usually attends the operation, as but few vessels are divided, owing to the horizontal direction of the incision. In the operation of Callisen, in which the incision was perpendicular, the hemorrhage, on the contrary, was frequently considerable.

The operation of Amussat may be performed upon either side; in cancer of the rectum, or recto-anal region, however, it is always best to select the descending colon. The procedure is usually difficult of execution, especially in infants and children, and, unless conducted with great care and judgment, is very liable to be followed by injury of the peritoneum.

Any tendency to undue contraction of the artificial anus should be counteracted by means of tents; and pains should be taken, as soon as the parts have sufficiently recovered from the effects of the operation, to furnish the patient with a suitable apparatus for preventing the tendency to the escape of fecal matter. In some cases, there is a strong disposition to protrusion and eversion of the mucous membrane of the bowel, but this generally soon disappears of its own accord. The greatest attention must constantly be paid to cleanliness.

The *results* of the various operations performed for the establishment of artificial anus up to 1851, have been carefully brought together by Mr. Caesar H. Hawkins, in an able paper published in the thirty-fifth volume of the *Transactions of the Medico-Chirurgical Society of London*. The number of cases analyzed was forty-four, of which twenty-one perished within the first five weeks, while of the remaining twenty-three, five died within six months, eight were either alive or left uncertain under one year, and nine lived twelve months or upwards. One of the patients survived seventeen years. In forty-two of the cases in which the disease was known, nineteen were cancerous, and of these, ten proved fatal within the first five weeks. Of the forty-four cases, the operation was performed through the peritoneum in seventeen, of which ten died, and seven recovered; and in twenty-seven cases external to the peritoneum, of which eleven lived upwards of five weeks. In two of the patients the small intestine was opened, and both died soon after the operation; three, in whom the cæcum was the seat of the anus, experienced a similar fate; while one in whom the arch of the colon was perforated lived for three months and a half. In all six the peritoneum had purposely been divided. The right colon and cæcum were opened through the peritoneum in four cases, of which not one recovered, while of six cases in which the serous

membrane was left intact, only two died. The left colon was opened in eight cases through the peritoneum, of which three proved fatal. Of twenty cases in which the operation was performed on the left colon through the lumbar region, or according to Amussat's method, nine died, and eleven recovered; that is, they survived the operation five weeks and upwards. The age of the different cases, varying from twenty-one to seventy years, did not appear to exert any very material influence upon the issue of the operation. Finally, of the twenty-one cases which terminated fatally within the first five weeks after the operation, two only died of peritonitis.

From the facts furnished by Mr. Hawkins, it is obvious that the operation of Amussat does not possess the advantages which were at one time ascribed to it, since the result of that operation, as compared with that of Littré, in which the peritoneum is opened through the walls of the abdomen, shows nearly an equal mortality.



## CHAPTER XIV.

## WOUNDS OF THE ABDOMINAL ORGANS.

## SECT. I.—WOUNDS OF THE STOMACH.

WOUNDS of the stomach are characterized by excessive pain in the epigastric region, by nausea, extreme prostration, and vomiting of blood, either pure or mixed with ingesta. The site of the external wound will often throw important light upon the diagnosis. The great danger is from effusion of the contents of the stomach, causing peritonitis. If the opening be small, situated at the lesser curvature of the organ, and inflicted during the empty state of the stomach, restoration may take place by the first intention; but, in general, such a result is not to be looked for, and in most cases death occurs, as in similar lesions of the intestines, in from thirty-six to forty-eight hours from inflammation. Occasionally the patient dies from shock. Wounds of the stomach are often complicated with copious hemorrhage, and with injury of the diaphragm, lungs, bowels, and other viscera. In some instances the patient escapes with a fistulous opening in the epigastric region, as in the celebrated case of Alexis St. Martin, so well described by Dr. Beaumont, and so well known to physiologists.

The *treatment* of wounds of the stomach must be conducted upon the same principles as wounds of the intestines, that is, they must be closed by suture, and the case managed afterwards with special reference to the prevention of undue inflammation. For the first few days nothing should be taken into the stomach but mashed ice, and that only in quantities sufficient to allay thirst and quiet irritability; after that, a little arrowroot, tapioca, or sago may be allowed. Where gastrography has been neglected, or rendered impracticable, it is best to withhold everything by the mouth until the edges of the wound have contracted adhesions to the adjacent parts, and to place our main reliance, as it respects the comfort and support of the patient, upon the application of ice to the epigastrium and the use of nourishing enemata. Laxatives are, of course, out of the question. Constipation and flatulence are relieved by injections; pain and vomiting, by morphia.

As wounds of the stomach are comparatively rare, I subjoin the following cases in further illustration of the subject.

A German, thirty-five years of age, getting into a brawl with one of his friends, received a deep cut in the lower part of the epigastric region, penetrating the stomach along its anterior surface for a distance of nearly three inches. The injury was inflicted with a large knife, within a few minutes after a full supper. I saw the man in less than

a quarter of an hour after the accident; he was pale and exhausted from the loss of blood, extremely restless, very thirsty, and constantly inclined to vomit. His abdomen was covered with ingesta, which had escaped through an opening in its walls large enough to admit the fist. Sinapisms were applied to the extremities, and turpentine was thrown into the rectum, to favor reaction; but the man grew weaker and weaker, and died in less than two hours after I reached him. The dissection disclosed a large quantity of coagulated blood in the peritoneal cavity, from the division of the branches of the gastric artery, and a considerable extravasation of undigested food mixed with the blood. The edges of the large wound in the stomach were much everted, thereby sensibly diminishing its orifice.

A young man, named Henry Bremaker, was stabbed with a knife in November, 1848, in his left side, between the eighth and ninth ribs, and about midway between the spine and sternum, the wound being about one inch long, and occupied by a piece of omentum. A finger passed into it, readily entered the cavity of the abdomen. A number of imperfectly masticated beans and other substances lay on the surface of the belly, leaving no doubt, especially as there had been no vomiting, that the stomach was also wounded. The patient suffered much pain; he was pale, and the pulse was considerably accelerated, but not wanting in force. Dr. Raphael, who saw him soon after the accident, contented himself with drawing the edges of the outer wound together with adhesive plaster, aided by a compress and bandage. An anodyne was administered, and perfect quietude enjoined.

Excessive thirst and restlessness set in within a few hours after the wound was dressed, followed by vomiting, in which the patient threw up a small quantity of blood. The breathing, after some time, also became painful and difficult. To afford greater play to the diaphragm the compress and bandage were removed. About half a pint of dark-colored fluid escaped from the wound, with evident relief of the unpleasant symptom. The pulse, however, gradually sunk, and the man expired sixteen hours after he was stabbed.

On the dissection, which I witnessed, it was found that the deep portion of the wound was upwards of two inches in length, the instrument having glided obliquely along the intercostal space between the eighth and ninth ribs, towards the sternum, and made an opening in the cordiform tendon of the diaphragm, sufficiently large for the passage of the entire stomach, along with a part of the colon and omentum, into the left thoracic cavity. The stomach was perforated at the great cul-de-sac by an opening nine lines in length, and situated four inches from the oesophageal extremity, the mucous membrane being everted, and of a deep cherry color. It contained about half a pint of ingesta. The left lung was completely collapsed, and of a bluish, macerated appearance. The corresponding cavity contained about a pint of bloody fluid, composed in great measure of the contents of the stomach, intermixed with beans and other substances. A small quantity of bloody serum was seen among the convolutions of the intestines, and in the pelvis. The peritoneum was sound.

Henry Drihaus, aged thirty-six, keeper of a coffee-house, was stabbed

in the abdomen, at 7 o'clock in the evening, November 19th, 1851, with a large knife, which passed in a horizontal direction, making a wound nearly six inches in length. It commenced a short distance from the umbilicus, at the right of the middle line, and terminated in the left hypochondriac region. When I reached the patient a few minutes after the accident, the whole of the small bowels, and the right portion of the arch of the colon, together with the omentum, were lying upon the belly, covered with blood, partly fluid, partly coagulated. The pyloric extremity of the stomach also protruded, and was laid open, at its anterior surface, to the extent of an inch and a half. The orifice was occupied by ingesta, and the mucous membrane was everted. There was also a small wound in the prolapsed colon and omentum, from which the blood covering the bowels appeared to have proceeded. The man was deadly pale, nauseated, and in violent pain. The pulse was feeble and frequent, and the surface covered with cold perspiration. Altogether the case presented a frightful aspect.

Five sutures, after Lembert's method, closed the wound in the stomach very accurately, and six interrupted that in the abdomen. As the deep portion of the outer wound was much retracted, I experienced great difficulty in effecting the desired apposition. The stitches were, therefore, passed through the muscles, close to the peritoneum. A thick compress and broad bandage completed the dressings. The knees and shoulders were elevated, to relax the abdominal muscles. A grain of morphia was given immediately, and another grain during the night, as the pain was excessive. Intense thirst and restlessness succeeded, and continued uninterruptedly until 4 o'clock the next morning, when the man expired in a state of complete exhaustion. A considerable quantity of blood was found in the belly, but no peritoneal inflammation.

## SECT. II.—WOUNDS OF THE INTESTINES.

Wounds of the intestines are of three kinds, the incised, lacerated, and punctured, including under the latter denomination all lesions from fire-arms and pointed weapons, as dirks, sabres, bayonets, and swords. In whatever manner, however, they may be inflicted, it will be found that they are all characterized by similar symptoms, and that they all require very much the same mode of treatment. Hence, the description of one will, with little variation, suffice for the rest.

All parts of the intestinal tube are liable to these lesions, though not in an equal degree. The ileum and the jejunum, owing to their great length, their floating condition, and the large space over which they are spread in the abdomen, are peculiarly prone to suffer; while the duodenum and the large bowel, especially the rectum, are rarely affected. The intestine alone may be injured, or the same blow which wounds the intestine may pierce the omentum, the spleen, liver, or other organs. Sometimes an important bloodvessel is laid open, thus complicating the case with hemorrhage. When the lesion is inflicted



with a ball, both the small and large bowel are often involved, as I have seen in several of my own cases. The same circumstance not unfrequently happens in wounds made with knives, dirks, and other sharp pointed weapons. Again, the tube may be merely pierced by the vulnerating body, or it may be completely transfixed, either on the same level, or at different heights. In 1854, I attended a man along with Dr. Cummings, in whom a pistol ball, entering a short distance below the navel, a little to the left of the middle line, completely perforated, in its upward and outward passage, the ileum, jejunum, duodenum, and arch of the colon, making thus eight separate orifices. Finally, instances occur in which the bowel is torn completely across, as when the injury is inflicted by a severe fall, or the kick of a horse.

Wounds of the intestines are of various forms. In general, they are oblique, but occasionally they are transverse, and sometimes, though rarely, longitudinal. Gunshot wounds are usually somewhat circular. In their dimensions, these lesions vary from the smallest puncture to an opening several inches in length.

*Symptoms.*—The symptoms of these injuries necessarily resolve themselves into two classes, those which are peculiar to the part immediately interested in the accident, and those which are furnished by the system at large. Both, unfortunately, are too often equivocal. This is especially apt to be the case within the first few hours after the receipt of the wound, in those instances—and these are by no means few—in which there is no protrusion of the bowel, or in which the opening in the wall of the abdomen is so small, so situated, or so shaped as to oppose an effectual barrier to the escape of the contents of the tube. When the intestine hangs out at the external wound, no difficulty can arise in regard to the nature and extent of the mischief. The lesion then admits of demonstration. But it is very different when the bowel is retained in the belly. In such an event, the most important symptom is an escape of feces, bile, mucus, ingesta, or fetid air at the opening in the wall of the abdomen. As these substances can proceed only from the alimentary canal, the stomach, or the gall-bladder, their presence is characteristic.

Another symptom, also of great value, especially when there is no protrusion of the bowel, is the sudden development of *tympanites*, not in the alimentary tube, but in the general peritoneal cavity. This phenomenon, which has not been sufficiently insisted upon by systematic writers, is often present when the others are absent, and is, therefore, of immense diagnostic consequence. It supervenes at various periods, from a few minutes to a number of hours, after the occurrence of the accident, and is always accompanied with a hollow, drum-like sound on percussion, with tenderness on pressure, and difficulty of respiration. Its development is generally very gradual, and sometimes it is so slow as hardly to attract any attention for more than a day. Occasionally it attains such an enormous height as to encroach seriously upon the diaphragm and abdominal viscera. I have seen cases where the tympanites was distinctly circumscribed or limited to particular regions of the abdomen. It is probable that, under such circumstances, the air is prevented from diffusing itself by the forma-

tion of adhesions consequent upon the inflammatory process. In fatal cases, the fluid always remains undiminished; but when recovery takes place, it is gradually absorbed, and ultimately, though, perhaps, not under several weeks, entirely disappears. It is commonly of a fetid character, and often escapes with an explosive noise on opening the abdomen.

Tympanites, however, does not attend all traumatic injuries of the intestinal canal. When the opening is very diminutive, amounting rather to a puncture than to a wound, properly so called, the escape of gas will either be entirely prevented, or it will occur only in a small degree, owing to the protrusion of the mucous membrane across the aperture, which, acting like a valve, thus effectually opposes the egress of feces, mucus, and even air.

A discharge of *blood* from the anus is another symptom, which, in connection with some of those just mentioned, is of considerable importance in the discrimination of this lesion. Still, as it may, and often does attend other affections, it cannot be regarded as at all characteristic. The quantity of blood evacuated amounts occasionally to many ounces. In several instances I have seen from a quart to half a gallon voided in the course of a few days.

I have never noticed vomiting of blood in wounds of the bowel, though such an occurrence is, I suppose, probable when the injury is seated in the upper portion of the tube, in consequence of the inverted action of its muscular fibres. However this may be, it is of no value whatever in a diagnostic point of view.

Wounds of the intestines are always accompanied by *pain* and tenderness of the abdomen, varying in degree in different cases and in different circumstances, being very slight in some, and exceedingly severe in others. They are always increased by pressure, coughing, sneezing, and a full inspiration, especially if some hours have elapsed since the occurrence of the injury. The pain varies in its character; generally it is dull and aching, but there are cases in which it is sharp, cutting, or colicky, and extremely depressing in its effects. On the supervention of inflammation, it usually becomes more persistent, as well as more intense, and is always attended with retraction of the lower extremities, the patient instantly assuming the posture best adapted to relieve the injured bowel from the pressure occasioned by the tension of the abdominal muscles.

The *constitutional* symptoms produced by a wound of the bowel are generally such as denote a severe shock of the nervous system; but as they are common to this and other injuries, they are of little consequence in a discriminative point of view. In almost all instances there is nausea, either alone or accompanied with vomiting; the patient feels faint, his countenance is pale, and his pulse is small and tremulous. These symptoms usually make their appearance within a few minutes after the infliction of the wound, and often continue with great obstinacy for several successive days, or, in fatal cases, even up to the time of dissolution. They are generally more violent and distressing in injuries of the small than of the large bowel, owing, as is supposed, to the more delicate organization of the former than of the latter, and to

its more intimate connection with the stomach and the sympathetic nerves. The prostration of the vital powers is not always in proportion to the extent of the wound, or the actual danger of the case. Some persons, it is well known, suffer much more severely from a slight than others do from a violent injury, for reasons which cannot always be explained, but which may, usually, be presumed to be dependent upon some constitutional peculiarity. Reaction occurs at various periods; sometimes soon, at other times not under many hours. Until it is fully established, there is occasionally a remarkable tendency to syncope, with an alarmed and agitated state of the mind, which hardly anything can calm or subdue. The countenance, in this event, has a pale, anxious, haggard expression; the pulse is small, frequent, and tremulous; the surface is bathed with clammy perspiration; the extremities are cold; the breathing is embarrassed, and there is frequent sighing, with excessive restlessness; the desire for cold air and drink is urgent; griping pains are complained of; and occasionally there are involuntary discharges from the bowels.

*Diagnosis.*—In the diagnosis of a wounded bowel important information may frequently be obtained, in regard to the direction, extent, and depth of the lesion, by a careful consideration of the size and shape of the vulnerating body, and the relative position of the parties at the time of the accident. Whenever, therefore, the means are at hand for such an investigation, the opportunity should not be neglected. If the opening in the wall of the abdomen be large, the best instrument for ascertaining its condition is the index-finger, or a grooved director; with either of these, it is generally easy to determine whether the wound involves the muscles only, or the muscles and the peritoneal cavity. The pocket probe is not well adapted to such an examination, as it is liable, from its small size, to have its point arrested among the tissues. Whatever instrument be employed, all officious interference must be avoided, as likely to do harm instead of good. In exploring the wound, it is important that the part and body should be placed as nearly as possible in the position in which they were at the moment of the accident. When the injured bowel protrudes at the external opening, the diagnosis is at once obvious, as the nature and extent of the lesion may be determined by simple inspection. The lesion, in the absence of pathognomonic symptoms, ought to be suspected when nausea and vomiting occur after a penetrating wound of the abdomen, accompanied with griping pains, great debility and faintness, jactitation, extreme anxiety, and cold sweats. The case is plain enough when there is a discharge of the contents of the alimentary tube, or a sudden development of tympanites, gradually increasing, and attended with decided tenderness of the abdomen.

It is an interesting fact, in relation to the present inquiry, that, although an instrument may pierce the peritoneal cavity, it need not necessarily wound the bowels, or, indeed, any other important organs. Nay, further, it may not only lay open this cavity, but completely traverse it, or even emerge at the opposite side, and yet inflict no serious mischief upon the contents of the abdomen. Instances like the latter are certainly uncommon, but that they do occasionally



occur is abundantly proved by the writings both of military and civil surgeons.

Numerous cases of penetrating gunshot wounds of the abdomen are recorded, in which the bowels did not appear to have suffered the least injury, and where recovery followed under the most simple treatment. In the fourth volume of the *Western Journal of Medicine and Surgery* is a case, reported by Dr. J. W. Richardson, of Tennessee, which was evidently of this nature. The ball, weighing two drachms and a half, entered the belly at the right side of the middle line, and issued midway between the last rib and the sacro-iliac symphysis, just to the right of the spine. There was no escape of gas, mucus, feces, or ingesta at the wound; but a little bloody urine was voided soon after the accident, and for more than a week afterwards there was some tension, with considerable soreness and swelling of the abdomen. The patient was perfectly well in less than a month.

*Hemorrhage.*—Wounds of the bowels are occasionally complicated with hemorrhage of the peritoneal cavity, caused by lesion of the vessels of the abdomen. A considerable quantity of blood sometimes flows back into this cavity from an opening in the epigastric artery; but most generally the bleeding proceeds from injury of the omentum, the mesentery, or some other structure, accidentally wounded along with the intestine. In rare instances the hemorrhage is derived from the aorta or vena cava. However this may be, unless the abdominal wound be large, very little blood, if any, will appear externally, so as to disclose the real state of the case; instead of this, it will pass back into the serous cavity, lodging in the folds of the intestines, descending into the pelvis, or diffusing itself extensively among the viscera. The amount and rapidity of the effusion will vary in proportion to the size of the wound and the volume of the vessel concerned. When the vessel is very large, and the opening considerable, the hemorrhage may be instantly fatal, or death may ensue in a few hours from the accident. In cases of an opposite character, the symptoms will be less urgent, and the patient will probably suffer no particular inconvenience, save what results from his temporary debility. The blood will soon coagulate, and, pressing upon the orifice of the bleeding vessel, will thus oppose an effectual barrier to further effusion.

The existence of internal hemorrhage, as a complication of a wound of the bowel, is denoted by excessive pallor of the countenance, a small, tremulous state of the pulse, frequent sighing, clammy sweats, coldness of the extremities, intense thirst, and constant jactitation.

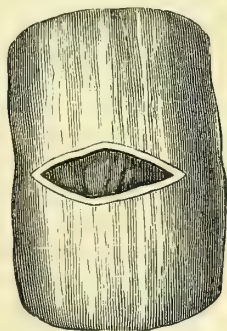
*Effects.*—The speedy, if not immediate, effect of almost every wound of the bowel is the extravasation of a portion of its contents. It is upon this circumstance, mainly, that the great danger of an injury of this kind depends. Were it not for the escape of fecal matter, and the contact of this matter with the peritoneum, there is reason to believe that the mortality from wounds of the intestines would be comparatively slight, or, at all events, much less than the experience of the profession has shown it to be. It seems, until very recently, to have been an axiom with surgeons that there is, properly speaking, no peritoneal cavity, and hence that, in perforation of the bowel, there

can be no fecal effusion. Now, such a conclusion as this is not only wholly gratuitous, but calculated to be exceedingly injurious in a practical point of view, from the fact that it must necessarily lead to erroneous principles of treatment. That there is a nice adaptation among the abdominal viscera to each other, and of these viscera to the walls by which they are inclosed, is unquestionable; but that they are so closely and equally pressed together as to afford no space for the lodgment of extraneous matter is certainly what is not true. So far, indeed, from this being the case, it may be assumed that, if there be no extravasation of fecal substance, after a wound of the bowel, it is because there is no substance of the kind present. The absence, then, of such an occurrence is, in all injuries involving the continuity of the alimentary tube, the exception to a great and important law, not the law itself, as was at one time supposed.

That the extravasation of fecal matter is influenced by the nature and extent of the wound, I ascertained long ago by experiments upon the inferior animals, as well as by observations on the human subject. I found, for example, in dogs, that, when the opening is six lines in extent, whether transverse, oblique, or longitudinal, there is almost invariably an escape of fecal matter, followed speedily by fatal peritonitis. If, however, the wound, whatever be its direction, does not exceed four lines in length, or a third of an inch, such a contingency will not only be less likely to happen, but in many cases, if not in a majority, nature, aided by appropriate therapeutic measures, will be fully competent to effect reparation.

The safety of the patient, in comparatively small wounds of the bowels, no doubt frequently depends upon the diminution which the opening experiences instantly after their infliction, in consequence of the contraction of the muscular fibres of the tube, and the eversion of its mucous membrane (fig. 410). The following experiments bear directly upon this point. 1. A longitudinal incision, two lines and a half in length, immediately contracted to one line and three-quarters, with a sufficient degree of eversion of the lining membrane to close the resulting orifice. 2. A similar wound, four lines long, diminished in a few seconds to three lines, by one line and a half in width; it assumed an oval shape, and the mucous tunic protruded on a level with the peritoneal surface, leaving no perceptible aperture. 3. An oblique cut, seven lines in length, contracted to five, by two and a half in width, with marked eversion of the lining membrane. 4. A transverse wound, two lines and a half long, was reduced almost instantaneously to two lines in diameter; it was of a rounded form, and the two outer coats of the bowel retracted so as to expose the mucous tunic. 5. In this experiment, in which the incision, likewise transverse, was half an inch in extent, the orifice assumed a rounded, oval shape, and was reduced to four lines, by two

Fig. 410.



and a half in width, the internal coat exhibiting, as in the other cases, a pouting, or everted arrangement.

These observations are of the deepest interest, as showing the efforts which nature makes to close a breach of this kind, the very instant almost that it is inflicted. The eversion of the mucous membrane forms a constant and striking feature in all incised wounds of the bowel, whatever be their shape, extent, or direction, and may be compared, in its effects, to the contraction and retraction which take place in the extremities of a divided artery. As the latter are intended to prevent the effusion of blood, so the former is intended to prevent the effusion of fecal matter. Both are wise provisions of nature, designed to protect the patient's life.

In gunshot wounds of the bowels, and in incised wounds, attended with severe contusion, the eversion of the mucous coat is generally very slight, and sometimes even absent. Owing to this circumstance, wounds of this description, even when very small, are extremely prone to be followed by fecal extravasation and fatal peritonitis.

When the contents of the bowel are effused over the peritoneum, the inevitable effect is death from inflammation. The period at which this occurs rarely exceeds sixty hours, and sometimes it takes place even considerably earlier. In a remarkable case of pistol wound, in a man, aged twenty-two, which fell under my observation in October, 1854, life was preserved for six days, under circumstances, apparently, of the most desperate character. The ball, entering the abdomen, about two inches below the navel, a little to the left of the middle line, ranged obliquely upwards and backwards, towards the right hypochondriac region, completely perforating the ileum, jejunum, and duodenum, together with the arch of the colon, thus making eight distinct openings. Fecal matter escaped at the external wound soon after the accident, but not afterwards. The man was shot on a Sunday evening, and lived until nearly the same hour on the following Saturday, having suffered but little pain, and dying completely exhausted. The bowels were confined during the entire period, and, what is remarkable, there was but little tympanites. The ball could not be found on the dissection. No important vessels had been injured. The peritoneum was everywhere much inflamed, and its cavity contained at least half a gallon of serous fluid, of a very fetid character, and intermixed with fecal matter. The bowels were extensively adherent both to each other and to the walls of the abdomen. The openings made by the ball had an irregular, ragged aspect, and were surrounded by a considerable quantity of plastic matter.

The extravasation of fecal matter generally produces inflammation of the peritoneum within a very short time, probably within less than an hour, after its occurrence. The disease, once begun, progresses with great rapidity, and often extends over nearly the whole surface of the membrane. The symptoms, denotive of its presence, are, violent burning pain of the abdomen, with exquisite tenderness on pressure, and retraction of the thighs; constipation of the bowels; a sharp, frequent and contracted state of the pulse; intense thirst; constant wakefulness; excessive restlessness; great anxiety; and coldness of the extremities.



In the latter stages there is generally some degree of nausea, with occasional vomiting; the pulse is weak and fluttering; the surface is bathed with a cold, clammy sweat; the features are collapsed; the breathing is oppressed and laborious; the belly is extremely tense and tumid; the strength rapidly declines; and, finally, the patient dies under all the symptoms of one sinking from the effects of mortification. The attack, as previously stated, rarely continues beyond two days and a half, and often terminates in a much shorter period. The appearances after death are always well marked, even when the disease has not been protracted. The peritoneal surface is highly inflamed, the bowels are covered with lymph, and the abdominal cavity usually contains a small quantity of turbid serum. Occasionally a considerable amount of pure blood, or blood mixed with lymph and other substances, is present. At the seat of the wound, and frequently also at other points, fecal matter, or other evidence of intestinal effusion is found. The edges of the opening are usually somewhat everted, and adherent to the surrounding parts, which are always extremely red and inflamed. Extensive adhesion generally exists between the bowels, as well as between the bowels and other structures; and, on penetrating the belly, there is almost invariably an escape of fetid gas.

*Prognosis.*—The danger of wounds of the intestines must necessarily be influenced by a great variety of circumstances, such, particularly, as the extent of the mischief, the nature of the vulnerating body, and the state of the patient's health at the time of the accident. A small and simple lesion will be much more likely to turn out favorably than one involving a large surface, or one complicated with injury of some other organ, or the perforation of a large vessel. The danger is also less serious in an incised than in a contused or lacerated wound, and in a superficial than a deep one. Persons occasionally perish from the most trivial accidents of this kind, from mere shock, apparently, of the nervous system; they lie in a pale and exhausted condition, and death takes place, unpreceded by reaction. On the other hand, recovery sometimes occurs under circumstances seemingly the most desperate and unpromising. No certain rule can, therefore, be laid down in respect to the prognosis of wounds of this description, which, however, must always be considered as severe accidents, liable, in a great majority of cases, to be followed by the worst consequences.

Wounds of the large bowel were regarded by the older surgeons as generally less dangerous than those of the small; a view in which I am inclined to concur, though the rule is not without many exceptions. The reason of this difference is, first, the more fixed condition of the large bowel; secondly, its more capacious caliber; and, thirdly, the more solid nature of its contents. All these circumstances, especially the first and last, are supposed, and not without reason, to be favorable to the prevention of fecal extravasation, the great danger in all injuries of this kind. Extravasation will also be less likely to happen if the bowel be empty at the time of the accident than if it be distended. The fecal matter, if very small, is sometimes limited by coagulating lymph, and its discharge ultimately promoted by the formation of an abscess; or chronic action is established in the serous membrane, and the patient,

after weeks or months of suffering, sinks under the exhausting influence of the malady.

*Mode of Reparation.*—Wounds and punctures of the bowel, unaccompanied by the effusion of fecal matter, heal, if left to themselves, either by the adhesion of their edges to the surrounding parts, or by the deposition of lymph upon their surface, and the gradual approximation of their lips. In the majority of cases, it is probable that the reparation is effected in the former manner, inasmuch as there is always a great tendency in the injured structures to attach themselves to those in their immediate vicinity. Even wounds of large size are occasionally cured in this way. In some instances, again, the breach is closed by a piece of omentum, which, projecting into it, fills it up like a tampon. When this occurs, the contiguous serous surfaces become firmly adherent to each other, and that portion of the plug which lies within the bowel, and assists in maintaining its continuity, is eventually absorbed; a circumstance which leads to the gradual approximation of the lips of the wound, and their ultimate reunion.

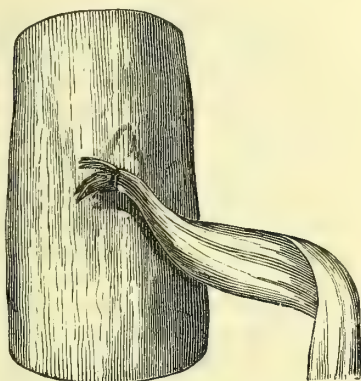
This extraordinary disposition to adhesion in the external surface and edges of these wounds to the parts around them, is nothing more than what might be expected when we reflect upon the structure of the peritoneum, and its invariable tendency, when inflamed, to pour out plastic matter. But it is otherwise with the mucous membrane. Here the process of reunion is not only much slower, but much less perfect; lymph is supplied very sparingly, or in quantities barely sufficient to fill up the chasm between the margins of the wound, and, owing to the heterogeneous and irritating character of the contents of the tube, a long time must necessarily elapse before it can become an organized intermedium. The little band thus formed adheres firmly to the bottom of the breach, but very slightly, if at all, at least for some days, to its edges. Gradually, however, it becomes more and more dense; vessels extend into it; its margins are flattened down; and by and by, after a period varying from several weeks to as many months, the adhesion is complete. Subsequently, or, indeed, while these changes are still in progress, the new matter is nearly all absorbed, the wound sensibly diminishes in size, and, ultimately, nothing remains to show the seat of the original injury, save a little seam or depression in the wall of the bowel. The whole process may be compared to that which nature employs in repairing ordinary ulcers of the intestinal mucous membrane.

The above, however, is only one mode in which the restoration of the mucous surface is effected. Another, though by no means a frequent one, is by granulation. Such an event is always to be expected when the plastic matter is detached by the feces, or when its vitality is destroyed by the irritating contents of the bowel. Under such circumstances, nature makes an effort to repair the breach by the formation of granulations, as in similar injuries of other textures. The process, however, is usually much more tardy than in the former case, the cicatrization is also less complete, and the intestine at the seat of the wound is much more apt to be puckered.

When the wound is sewed up, the mode of reparation is essentially

the same, whatever may be its form. The inflammation which is lighted up induces an effusion of lymph, which is speedily followed by the adhesion of the injured coil to the neighboring structures, among which it is sometimes completely buried. At other times no such adhesion occurs, but the affected part throughout the entire line of suture is coated with a layer of plastic substance, by which the continuity of the serous membrane is finally re-established, and the threads used in sewing up the wound are concealed from view. In dogs there is, in a great majority of cases of this injury, an attachment of the omentum to the surface and edges of the wound, as seen in fig. 411, which thus remarkably assists in the process of restoration; but it is rarely, according to my experience, that we witness such an occurrence in the human subject, owing, perhaps, to the fact that the omentum is so much smaller in man than in the canine race of animals.

Fig. 411.



The manner in which the ligatures used in sewing up a bowel are detached varies, as might be expected, according to the mode in which they are applied. Both in the interrupted and the continued sutures, with their different modifications, the threads, provided their extremities are cut off close to the surface of the wound, invariably fall into the interior of the alimentary canal, along with the contents of which they are afterwards evacuated. The reverse is, of course, the case when the ends are permitted to hang out at the abdominal opening. The period at which the detachment of the ligatures happens varies from eight or ten days to several weeks. In dogs, I have frequently found them still firmly adherent at the end of a month.

Effects similar to the above follow when a ligature is tied firmly round a bowel, or round the edges of a wound only a few lines in diameter. The cord gradually cuts its way through the different tunics of the tube, the continuity of which is re-established by the effusion of plastic matter upon the constricted part.

Gunshot wounds of the bowels are repaired in the same manner as incised. The plastic matter, effused as a consequence of the resulting inflammation, glues the injured surface firmly to the surrounding parts, so that by the time the bruised and lacerated edges of the opening slough off, as they frequently do after such accidents, there is no longer any risk of fecal extravasation. The wound afterwards gradually diminishes in diameter, and, the process of cicatrization being complete, the tube resumes its original appearance, with the exception of a slight contraction at the seat of the injury.

*Treatment.*—From what has been said, it is evident that the great danger in this class of injuries is from fecal effusion, so liable to occur even when the wound is comparatively insignificant. That this is true

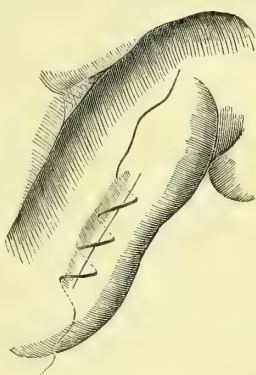


does not admit of any doubt, and hence there can be no difficulty in regard to the proper line of practice to be pursued under such circumstances. It is simply to sew up the wound, and to restore the bowel to its original situation, with as little delay as possible, watching the case most assiduously afterwards, with a view of preventing undue peritoneal inflammation; for whenever this is permitted to obtain the ascendancy, the patient must necessarily perish. It is folly to think of any other practice, and the sheerest nonsense to talk about the irritating nature of intestinal sutures. I have seen enough of wounds of the bowels, both in man and animals, to satisfy me that enteroraphy is, in itself, one of the most innocent of operations, and it is only surprising that it should ever have been regarded in any other light. What possible harm can result from depositing a little thread in the coats of an intestine, and retaining it there for ten or a dozen days? If any, I am sure it is beyond my comprehension. Some inflammation, of course, will be produced, but this is precisely what is needed for the cure of the wound and the safety of the patient. The operation is neither difficult nor painful; any one can perform it, and as it is the only safeguard against fecal extravasation, there should never be any hesitancy about the propriety of it. Even if the wound be not more than a line and a half in length, the bowel ought not, in my judgment, to be returned without stitching it. Fecal extravasation might occur, and why, therefore, should the patient be subjected to the risk of such a contingency? In several of my experiments death was produced, not by sewing up the bowel, or by the manipulation employed in performing the operation, but by the escape of fecal matter, along the large interspaces, between the sutures, which thus allowed the wound to gap, and favor the occurrence in question. I found that whenever the closure of the wound was incomplete there was danger of intestinal effusion.

There are but two sutures which I regard as at all suitable for sewing up a wound of the intestines. These are the continued and the interrupted, with the modifications of the latter proposed by Lembert and Gely. All the other expedients of this kind, with which I am acquainted, and I believe I have a knowledge of every one that has ever been suggested, are complicated, uncertain, and, therefore, inapplicable. The continued and interrupted sutures are easily executed with a long, slender cambric needle, armed with a small, but strong and well-waxed silk thread.

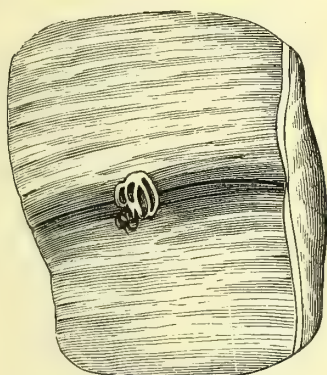
The *continued* suture (fig. 412) is made by passing the needle from one side of the wound to the other, taking care to carry it across all the tunics of the bowel, except the mucous, in such a manner as to bring the serous edges in the most accurate apposition. Each stitch should not include more than half a line of substance, and the ends of the thread, being well secured at each angle of the opening, should be cut off close to the surface of the tube. In performing the interrupted suture, the needle is introduced in the same manner as in the operation just described, the ligatures being placed about two lines apart, but none being tied until all have been applied. The ends are then secured with a double knot, and cut off close. As the sutures become detached they gradually pass into the intestinal tube, into which they finally

Fig. 412.



Continued suture.

Fig. 413.

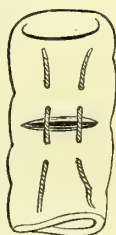


Ligature partially detached.

drop, to be discharged along with the fecal matter. In the adjoining figure (fig. 413), the ligature is seen to be partially separated.

In *Lembert's modification*, which I have often performed successfully upon dogs, and which is illustrated in fig. 414, a short stitch, including only the peritoneal and muscular coats, is taken on one side of the wound, about two lines and a half from its edge; the needle is then carried across the gap, and a similar stitch is taken on the opposite side. In this way one thread after another is deposited, the intervals between them not exceeding the sixth of an inch; and when they are all arranged, they are drawn firmly together, and tied with a double knot, the ends being cut off as in the ordinary operation. By this procedure the wound is completely closed in every portion of its extent, its lips being inverted so as to approximate their serous surfaces, at the same time that they form a ridge, upwards of a line in length, within the tube.

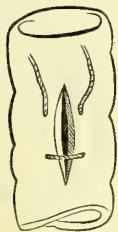
Fig. 414.



Lembert's suture.

*Gely's suture*, which is merely a modification of that of Lembert, is made with two needles, which are inserted near the angle of the wound, about one line from its edge; they are then carried along the interior of the bowel, parallel with the wound, for the sixth of an inch, when they are brought out precisely at the same level, so as to appear again on the peritoneal surface. The threads are then crossed, the right needle being passed through the puncture made by the left; and conversely, when the ends are firmly tied, and cut off close, as in the ordinary operation. The number of sutures varies, of course, according to the extent of the cut. In this way the edges of the wound are thoroughly inverted, and, consequently, all danger of fecal effusion is prevented; the coaptation being so accurate as to conceal the ligatures. The annexed cut (fig. 415) will serve to convey a correct idea of the manner of practising this suture.

Fig. 415.



Gely's suture.

In small wounds, whatever may be their direction, I am inclined to

give a decided preference to the interrupted suture, performed in the ordinary manner. It is easy of execution, and, if proper care be taken in placing the stitches, the most perfect closure can be effected with it, even as it respects the serous edges of the wound. Of Lembert's modification of this method, I have also a favorable opinion, though it is more complicated, and more liable to be followed by undue contraction of the bowel at the seat of the injury. When the wound is of unusual length, the continued suture will be the most suitable, inasmuch as it admits of easier application, and affords fewer chances for fecal extravasation. If the wound be a mere puncture, its edges may be included in a ligature, as is occasionally done in the operation for strangulated hernia.

The wound being effectually closed, the next step is the *replacement* of the bowel. This is always easy enough when there is a large external opening, but often very difficult when the opening is small. In the latter case, the bowel is sometimes so closely girted that it cannot be returned without dilating the wound in the wall of the abdomen. A small incision, however, with a probe-pointed bistoury, carried in the direction of the muscular fibres, will generally suffice for the purpose. Whenever any difficulty is apprehended, it is well, before resorting to the knife, to place the patient in a proper position for relaxing the abdominal muscles. For this purpose he should lie upon his back, the head being supported by a large pillow, the pelvis elevated higher than the shoulders, and the lower extremities bent at the hips and knees. If the bladder be much distended it should be previously emptied; and there should be no coughing, holding of the breath, or any exertion whatever calculated to impede the reduction. These arrangements being completed, the surgeon holds the bowel with his left hand, while with the right he pushes it gently back, beginning always with the portion that was protruded last, or that nearest the wound. These efforts are continued until the whole mass slips into the peritoneal cavity, when the external wound, closed by several points of the interrupted suture, carried down deeply through the muscular substance, is supported by a broad, thick compress and bandage, to prevent reprotrusion.

When the bowel is greatly distended with air, and the reduction cannot be effected without dilating the external wound to an unwarrantable extent, or when the employment of the knife is rendered improper on account of the proximity of an important vessel, as the epigastric artery, I would advise that the tube be punctured with a large needle, or even with the point of a narrow bistoury, to let out the redundant and obstructing fluid. Such an operation, which should, of course, always be performed with great care, can do no possible injury, certainly nothing like the injury that is inflicted in dilating the wound. A very delicate trocar, one not larger than a crow-quill, might be substituted for the needle and bistoury.

In our attempts at replacement, it is all important to know that the bowel has actually slipped into its natural situation. If the external wound is very devious, or if the peritoneum has been detached from its inner edges, a portion of the tube might be retained on the outside



of the serous cavity, and thus experience all the bad effects of strangulation. To guard against such an event, the surgeon should not rest satisfied until he has assured himself that the passage is perfectly free, and that his finger has been fairly within the abdomen, or in contact with the convoluted surface of the bowel. \*

Penetrating wounds of the abdomen are rarely unattended by some protrusion of the omentum. Sometimes, indeed, it is injured along with the bowel, pierced, cut, or contused. However this may be, it should always be promptly restored to its natural position, but not, as a general rule, until after the replacement of the intestine, any bleeding vessels being previously secured with a small ligature, brought out at the external wound.

What should be the conduct of the surgeon in wounds of the bowel *without protrusion*? This occurrence is far more frequent than wounds with protrusion, and it becomes, therefore, a matter of paramount importance to determine, if possible, the proper mode of practice adapted to such an emergency. To my mind the course to be pursued is perfectly clear. It has been seen that all wounds, however small, should be secured with suture, as the only guarantee against fecal effusion. Now, if this be true of small wounds, how much more important is it in regard to large wounds, which must inevitably be followed by an escape of the contents of the tube, and, as a necessary result, by fatal peritonitis? The discharge must be prevented, or, if it have already taken place when we are called to the case, the most prompt and decisive measures must be adopted for its successful removal. How, then, is this to be accomplished? By the surgeon folding his arms, and looking upon the scene as an idle and disinterested spectator? If he do, his patient will perish from peritonitis just as certainly as if his skull had been severely fractured, and a large portion of his brain let out; or just as certainly as if he had swallowed an overdose of hydrocyanic acid, arsenic, or any other deadly poison. The proper mode of treatment, then, resolves itself into this, to dilate the external wound, if it be not already sufficiently large, to close the orifice in the bowel, and to clear away the effused matter. By this procedure, promptly and efficiently executed, the patient is placed in no worse condition, to say the least, than a female who has undergone the Cæsarean section, or a person whose abdomen has been ripped open in the first instance; recovery from which is, as is well known, by no means infrequent. The truth is, the fatality of penetrating wounds of the abdomen has been greatly exaggerated. Injuries of this kind have been a sort of bugbear with practitioners, not so much on account of what they themselves have witnessed, as on account of what they have heard from others; and hence a prejudice has arisen against this practice so deeply rooted as to render it almost impossible to surmount it by any course of argument that can be brought to bear upon the subject.

But this practice of dilating the external wound, and searching for the bowels, is not universally applicable. If, for example, the orifice in the intestine is very diminutive, as it may be supposed to be when it has been inflicted by a small knife, such a step would be highly im-

proper, as tending seriously to complicate an injury, which, if left to itself, might heal without the risk of fecal extravasation. Equally improper, in my judgment, would it be to pursue such a course when, from the history of the case, there is reason to believe that the bowel has been wounded in different places, as when the injury has been caused by a ball. An instance has already been detailed where a projectile of this nature perforated the tube at four separate points, involving the ileum, jejunum, duodenum, and colon. Such cases are necessarily fatal, and it is not proper, therefore, to aggravate the patient's suffering by making an extensive incision into the wall of the abdomen, with a view of sewing up the internal wound.

When the protruded parts are covered with dirt, feces, and blood, or other extraneous substances, they should be carefully cleansed before they are reduced. The necessity of this procedure is self-evident. The best article for the purpose is tepid water, squeezed from a sponge held some distance off. The stream thus produced is well calculated to detach the foreign matter, whatever it may be, without the induction of additional irritation. In no case should the parts be sponged or wiped. If the matter adhere very firmly, it may be picked off with the finger or the forceps. A similar course is pursued when the bowels are besmeared with blood, feces, and other substances, without any lesion of their tunics.

When blood is extravasated in considerable quantity into the peritoneal sac, as is evinced by the soft and tremulous state of the pulse, the pallor of the countenance, the coldness of the extremities, and the constant disposition to swooning, the patient must immediately be placed in the recumbent posture, and made to take large and frequently-repeated doses of acetate of lead in union with opium. Sinapisms are applied to the hands and feet, and the abdomen is covered with cloths wrung out of cold water, or, what is better, with a large bladder partially filled with pounded ice, or some refrigerating mixture. The abdomen is, at the same time, encircled with a broad bandage, to afford equable support to the viscera, and thus assist in promoting the coagulation of the blood. When there is reason to suspect that a large artery has been opened, the most effectual practice will be to cut down upon the parts, and apply the ligature. Such a procedure, desperate as it may seem, would certainly be preferable, when the wounded artery is within reach, to letting the patient perish from hemorrhage.

The bowel having been replaced, the first and most important object is to guard against the occurrence of *peritonitis*, the great danger after every injury of this kind. Perfect quietude in the recumbent posture, the early and copious abstraction of blood, especially if the patient be plethoric, or the wound extensive, and the most rigid observance of the antiphlogistic regimen, are the means upon which our reliance is mainly to be placed in the first instance. As to purgatives, their use is not to be thought of, even for a moment. On the contrary, the bowels must be locked up as speedily as possible, and be so maintained for many days by the frequent exhibition of anodynes. The object should be to prevent all muscular contraction in the tube until the

wound is tolerably well cicatrized, and all danger of peritonitis is passed. To insure this result, two grains of opium, or its equivalent of morphia, should be administered at regular intervals, at least every eight, ten, or twelve hours. The action of the medicine must be sustained, not wavering. Even the mildest enemata should be avoided, unless they are found to be absolutely indispensable to the comfort of the patient, by promoting the discharge of flatulence. When, at length, it is determined to use purgatives, none but such as are of the most simple nature should be given, as Epsom salts, Seidlitz powder, or citrate of magnesia. These articles not only, in general, agree well with the stomach, but they also liquefy the feces, thus rendering them less liable to be arrested at the affected part, to derange the sutures, and to disturb the healing process. I am satisfied that practitioners are not sufficiently aware of the importance of this mode of treatment, and that, as a necessary consequence, much mischief is produced by its neglect. They forget that whatever tends to excite peristaltic action must necessarily interfere with the reparative process, and that fecal matter is, in itself, usually exceedingly harmless, even when long retained in the intestinal canal, as is exemplified in the treatment of peritonitis, and after operations for the relief of vesico-vaginal fistule and laceration of the perineum.

The *pulse* is attentively watched, and any tendency to undue reaction is promptly met with the lancet, or the application of leeches to the abdomen. The amount of blood abstracted must vary according to the indications of the case, particularly the age and constitution of the individual, the return, continuance, or increase of local pain, the force and frequency of the pulse, and the extent of the injury. The first bleeding should, in general, be tolerably copious, but after this, six, eight, or ten ounces will be sufficient at each repetition. In this manner we prevent inflammatory action, or moderate it materially, if it has already taken place, without inducing too much prostration. It must be recollected that the pulse in peritonitis is hard, wiry, and contracted; a circumstance calculated to throw the practitioner off his guard, and lead him into the error of omitting the abstraction of blood at a period when it is loudly called for, and when, in truth, it can only be of any service in arresting the progress of the disease. The detraction of blood, however, is not always admissible. The shock sustained by the system may be unusually severe; the reaction may be tardy and imperfect; and the patient may lie, perhaps for several days, in a dozing state, with a small, tremulous pulse, a pallid countenance, and cold extremities; demanding imperatively the employment of stimulants instead of depletory remedies. The abdomen is fomented with cloths wrung out of a hot solution of opium; sinapisms are applied to the extremities; and free use is made of brandy and carbonate of ammonia. The urine is drawn off, if necessary, with the catheter; and, if cough be present, it is combated by the usual means, its progress being arrested as speedily as possible, lest the concussion thus induced should prove detrimental by interfering with the reparative process. Should tenesmus be present, relief is attempted by anodyne injections or opiate suppositories. If the abdomen be very tender and tympanitic, it



should be covered with a large blister, sprinkled with morphia, and retained until thorough vesication is produced.

The *diet* must be of the most simple nature. For the first few weeks, it should consist chiefly of amylaceous articles, as arrowroot, tapioca, or sago; afterwards it may be more nutritious, though still fluid. Solid, stimulating, or flatulent food is not to be used for several months. Cold water, flaxseed tea, or gum Arabic water, simple or acidulated, form the best drinks. When irritability of the stomach exists, the use of ice will be grateful and beneficial. In a word, the patient should be half-starved, and depleted as much as may be consistent with the restorative process. The treatment must be prompt and energetic. The great error generally is that blood is not abstracted sufficiently early, or before the peritoneal inflammation has made such inroads upon the system as to render it impossible to save the patient.

The *external wound*, in favorable cases, will generally unite by the first intention, and will require none but the most simple dressings; but when this does not take place, or when an artificial anus follows, the utmost attention should be paid to cleanliness. As the opening contracts, means are to be employed to prevent the escape of fecal matter, and induce it to resume its natural channel. When the patient is able to sit up, or walk about, the weakened parts are to be supported by a suitable truss, which should be worn day and night, to guard against the separation of the edges of the wound, and the consequent protrusion of the abdominal viscera.

After *convalescence* is fairly established, as well as for some time subsequently, great attention should be bestowed upon the bowels, which must constantly be kept in a soluble condition, that no undue accumulation of feces may take place in the injured portion of the tube. The diet must also be very light, and the food carefully masticated before it is swallowed. All rough exercise, as riding on horseback, jumping, running, and even rapid walking, must be prohibited.

### SECT. III.—WOUNDS OF THE LIVER, GALL-BLADDER, AND SPLEEN.

Wounds of the *liver* are infrequent in civil practice, but common enough in military. Varying in their nature, site, and extent, they are generally attended with considerable hemorrhage, and are always to be regarded as serious accidents. The symptoms are often extremely obscure. The most reliable, perhaps, in a diagnostic sense, are, a fixed pain, and a feeling of weight in the region of the affected organ, and a discharge from the wound of bilious matter, of a yellowish or greenish color, very thin, and of a viscid consistence. Along with these symptoms there is generally gastric irritability, with frequent vomiting, great thirst, constant jactitation, and excessive prostration, occasionally amounting to complete collapse. If the patient survive a short time, the eyes, skin, and urine become jaundiced, attended with violent headache, and indescribable languor. Sometimes the nature of the accident is revealed by an escape at the wound of hepatic tissue. In most cases important information may be obtained, in regard to the

probable character of the injury, by observing the situation and direction of the external wound, or the course pursued by the vulnerating body. When two openings exist in the hepatic region, at opposite points of the body, and there is at the same time a discharge of bilious matter, there can hardly be any doubt respecting the diagnosis. In wounds of the gall-bladder there would probably be a flow of pure bile.

It is easy to understand why wounds of the liver are so frequently attended with severe hemorrhage. The organ is extremely vascular, having three distinct sets of vessels, the hepatic artery, the portal vein, and the hepatic veins; and hence it is impossible for any weapon, however small, to penetrate the parenchymatous substance without dividing some of their branches. If the wound involve a large vascular trunk, the hemorrhage may prove fatal in a few minutes, or, at farthest, in a few hours.

An Irishman, aged 28 years, in an affray, in November, 1855, received a cut in the epigastric region, three inches long, and transverse in its direction. It penetrated the peritoneal cavity, wounding the left lobe of the liver, which projected through the external opening. He lived thirty-six hours, looking very pallid, and having a small, feeble pulse. He bled considerably at the wound. On dissection, performed by Dr. Gilpin, the medical attendant, we found the cut in the liver to be an inch and a half in length by three-quarters of an inch in depth; the parts around were incrustated with coagula, and nearly three quarts of fluid blood were contained in the abdominal cavity. There was hardly any trace of peritonitis. A little wound, not three lines in length, existed in the omentum. The man had evidently died from loss of blood, chiefly from the liver.

The subjoined case shows that recovery from a wound of the liver is not impossible, even under apparently the most desperate circumstances.

Harvey, a colored boy, aged eight years, was accidentally shot with a pistol, July 30th, 1845, the ball entering on the right side, between the eleventh and twelfth ribs, nearly midway between the linea alba and the spine, and emerging on the opposite side of the spine, not quite half an inch from the median groove, both openings being situated on the same horizontal plane. Considerable hemorrhage followed, which, together with the shock of the injury, produced an alarming degree of prostration, lasting upwards of forty-eight hours. At my first visit, at the expiration of this period, he was literally in a state of collapse; his pulse could scarcely be felt, the extremities were cold, the respiration was almost imperceptible, and, in short, everything clearly indicated that he had received a most severe, if not a fatal wound. He had taken neither food, drink, nor medicine since the accident, and lay in a profound stupor, from which it was impossible to rouse him.

Under the influence of injections of brandy and hartshorn, and sinapisms to the extremities, chest and spine, the boy began to revive, and at the end of twenty-four hours the reaction seemed to be complete. A probe, introduced at the anterior wound, passed readily in the direction of the liver, but did not issue behind. In a few days free suppuration

occurred, especially at the posterior orifice, attended by the discharge of a slightly greenish, viscid fluid, having every appearance of bilious matter. This continued for about ten days, when it gradually ceased, both wounds closing in less than a month. The treatment, after the establishment of reaction, was extremely simple, consisting of an occasional laxative, and of light, but nutritious food, with a liberal use of brandy. The recovery was complete, the boy being now, fourteen years after the accident, alive and well. In 1851, when I last examined him, the anterior scar was four inches below the axilla, as the arm hung by the side, and six inches from the posterior one.

The liver is sometimes severely lacerated from falls, blows, or kicks upon the side, or by the compression caused by the body being forcibly jammed in between two hard, resisting objects, as a post and the wheel of a carriage. The number, extent, situation, and direction of the fissures vary so much in different instances as to render anything like a definite statement impossible. The following case will serve as an example of such an accident.

John Shidaker, a stout, athletic German boatman, aged twenty-three, was admitted under Dr. Pyles, into the Louisville Marine Hospital, June 29th, 1844, on account of remittent fever. A few days after, in a fit of delirium, he jumped off the portico upon the pavement below, a distance of fifteen feet, bruising and otherwise injuring several parts of the body. Death occurred in an hour after the accident. The liver, somewhat enlarged, softened, and of a dark bluish color, was found to be lacerated in thirteen places. The rents run in different directions, and, with the exception of two, were perfectly distinct from each other. They varied in length from a few lines to four inches, and in depth from two and a half to six lines, none extending completely through the substance of the organ. The spleen was ruptured on its convex surface, the right kidney ecchymosed, and the small intestine extensively contused. The abdominal cavity contained upwards of eight pounds of fluid blood. None of the large vessels were injured.

In the *treatment* of wounds of the liver the great object is to limit inflammation, by the most perfect quietude, gentle laxatives, and a careful restriction of the diet. If the patient be young and robust, he may require the use of the lancet; but, in general, it is better to content ourselves with leeches, fomentations, and blisters. When suppuration is threatened, mercury, to the extent of ptyalism, is administered, to modify the inflammatory action and favor resolution. Pain is relieved by the liberal use of anodynes.

Wounds of the *gall-bladder* are always fatal, as the escape of bile into the abdominal cavity is inevitably followed by destructive peritonitis. Division of its duct, as well as of the hepatic and choledoch ducts, is productive of similar consequences.

Wounds of the *spleen* are still more rare than wounds of the liver, which they strictly resemble in their character and in the mode of their production. The prognosis is usually unfavorable, rather on account, however, of the consequent hemorrhage than the severity of the resulting inflammation. When there is a large opening in the side or abdomen, a portion of the spleen may protrude, thus affording an opportunity



of ascertaining the true nature of the lesion by direct inspection; but, in general, the only phenomena which the practitioner has to guide him in the formation of his opinion of the case are, the site of the external wound, the fixed nature of the pain, and the extreme pallor of the countenance, indicative of the great hemorrhage which is so liable to follow such accidents. The absence of symptoms of intestinal, gastric, and other lesions affords important negative evidence.

The *treatment* of wounds of the spleen is to be conducted upon general antiphlogistic principles, of which rest and light diet are among the most important. If there is copious hemorrhage, acetate of lead and opium should be administered in large and sustained doses, aided by the internal and local use of ice. Stimulants are employed warily, lest the reaction be great and sudden, reinviting hemorrhage, or hastening inflammatory development. If the wounded organ protrude, or lie within the edges of the outer opening, prompt replacement is effected; not, however, if, upon examination, it appear that the wound is large, and disposed to bleed much, for, in such a case it will be much better to let the part remain in its impacted situation than to restore it to the abdominal cavity, thereby favoring profuse effusion from the divided and now unsupported vessels. I am inclined to believe that most of the recoveries after lesions of this kind are due to the partial escape of the organ from the abdomen, and the compression of the wounded structures by the edges of the external orifice. Hence, the circumstance is to be regarded, at least sometimes, rather as a favorable than as an untoward occurrence. If the splenic artery be pierced or severed, the ligature must be employed, even at the risk of greatly enlarging the external wound.

Instances occur in which the spleen protrudes some distance beyond the external wound, in a state of severe inflammation, several days having, perhaps, elapsed since the infliction of the injury. The proper treatment, in such an event, I conceive, is not to attempt the restoration of the projecting portion, lest it should mortify, or lead to dangerous hemorrhage, but to excise it on a level with the surrounding surface. The propriety of this practice is sanctioned by the report of numerous cases in which it was adopted.

*Rupture* of the spleen is much more common than wounds of this viscus, being sometimes produced by the most trifling accidents, especially if there be considerable softening of its substance, as so frequently happens during the progress of intermittent fever. Under such circumstances, the organ has been known to give way spontaneously, or under the slightest violence, as a blow upon the abdomen, a sudden twist of the body, or straining at stool. The accident is usually fatal in a few hours from the loss of blood, which is often effused in immense quantities, and which no remedies can control.

#### SECT. IV.—FOREIGN BODIES IN THE STOMACH AND BOWELS.

Foreign bodies, varying much in their character, occasionally descend into the stomach, and becoming arrested there, cause great distress,

and sometimes even death. Jugglers in the exercise of their profession and persons intent on self-destruction, are, perhaps, the most common subjects of such accidents. A few years ago a man in Iowa, in performing some tricks at legerdemain, allowed a bar of lead, ten inches long, upwards of six lines in diameter, and weighing one pound, to fall into the stomach. The usual symptoms are, violent pain in the epigastrium, extending about in different directions, a sense of weight and obstruction in the stomach, nausea, and constipation of the bowels. The patient is generally able to walk about, and even to attend to business, especially during the first few days after the introduction of the extraneous body.

The manner in which these substances are disposed of varies. Pieces of bone, cartilage, pins, needles, and coins, often pass into the bowels, and are finally discharged along with the feces. When the body lodges, and is productive of pain and danger, extrusion must be effected with the knife, the place of incision being regulated by the site of the intruder, which can often be distinctly felt through the walls of the abdomen. In the case above alluded to, Dr. Bell, of Wapello, removed the bar of lead by making an incision, four inches in length, from the umbilicus to the false ribs, some distance beyond the median line. The opening made in the stomach was just large enough to admit of the passage of the bar, and required no sutures, as it became immediately closed by the contraction of the muscular fibres of the organ. The external wound was stitched in the usual manner. No untoward symptoms occurred, and the man recovered in less than a fortnight.

The operation of *enterotomy* is sometimes required on account of the presence of a foreign body in the bowels, whether formed within, or introduced from without. In this country, intestinal concretions are exceedingly rare, but in certain parts of Europe, especially in Scotland, they are by no means uncommon, and occasionally call for the use of the knife. In the latter country, they usually consist of the fibres of the beard of the oat, cemented together by albumen and phosphate of lime, and sometimes acquire a very large bulk, weighing many ounces, and even three or four pounds. When small, they generally move about, changing their place from time to time; but when the reverse is the case, they are liable to become impacted in a kind of pouch, formed by the expanded tube. In general, they are solitary, but now and then they are quite numerous, as many as several dozens being found in the same individual. Their increase is usually tardy. The symptoms denotive of their presence are colicky pains, a sense of weight and soreness at the site of the concretion, dyspeptic derangement, and mechanical obstruction to the evacuation of the feces, with gradual emaciation, and failure of the general health. When the foreign body occupies the rectum or sigmoid flexure of the colon, the patient is tormented with a constant desire to go to stool, tenesmus, and distress in the sacro-lumbar region. When the concretion is large, or the emaciation considerable, it can generally be felt through the walls of the abdomen, and when several are lodged together, they may even be made to strike against each other, so as to cause a distinct noise.

These concretions are sometimes ejected by vomiting or stool; when situated in the rectum, they may occasionally be extracted with the finger, scoop, or forceps. When they are not disposed of in this way, and life is in danger, enterotomy must be performed, and, not unfrequently, the operation proves successful. An incision of adequate length being made through the abdomen, in the direction of the muscular fibres, and at the site of the foreign body, the bowel is laid open to an extent barely sufficient to seize and extract it, when the opening is immediately closed with the continued or interrupted suture, as may be deemed most advisable. The external wound is treated in the ordinary manner.

Foreign bodies, introduced from without, give rise to the same train of symptoms as those formed within; but, in general, the effects are more violent, and the treatment requires to be more prompt and decisive. When the ordinary remedies have failed, recourse is had to the knife, the two wounds being managed afterwards in the same manner as in the former case. The operation is, unfortunately, not often successful, chiefly for the reason, perhaps, that it is commonly performed too late. In a case under the charge of Dr. Samuel White, of Hudson, New York, early in the present century, a large teaspoon, swallowed in a paroxysm of delirium, was extracted in this way from the ileum, and the man recovered in a few weeks.

#### SECT. V.—WOUNDS OF THE MUSCULAR WALLS OF THE ABDOMEN.

Wounds of the muscular walls of the abdomen are, like similar injuries elsewhere, of various kinds, incised, punctured, lacerated, contused, gunshot, and poisoned. In character they may be simple or complicated; in extent, superficial or deep, small or large; in direction, horizontal, oblique, or vertical. Exhibiting no symptomatological peculiarities worthy of special notice, these different classes of wounds are often of a grave nature, liable to be followed by the worst consequences. Thus, there may be profuse hemorrhage, extensive laceration of the peritoneum, or violent contusion of some of the abdominal viscera, putting life in jeopardy, either immediately or remotely, by shock, exhaustion, or inflammation.

The bleeding attendant upon these accidents proceeds from various sources, according to the region of the abdomen in which they are situated. In general, it is derived from the epigastric, mammary, circumflex, and lumbar arteries, or some of their principal branches. Usually small and easily controlled, it is occasionally exceedingly profuse and arrested with great difficulty. If the wound is of a valvular form, a large quantity of blood may accumulate immediately beneath the skin, or in the cellular tissue beneath the muscles; forming, in the one case, a diffused, bluish swelling, and, in the other, a hard, circumscribed tumor. Or, the blood, instead of collecting externally, may escape into the peritoneal cavity, thus constituting a very dangerous, because concealed, bleeding. In the latter case, the nature of the hemorrhage will be indicated by a ghastly pallor of the countenance, by cold,



clammy sweats, and by great feebleness of the pulse, along with frequent sighing, intense thirst, and excessive restlessness. If the quantity of blood poured out be considerable, it may produce sensible enlargement of the hypogastric region, soft at first, and solid afterwards, as the fluid always has a tendency to gravitate to the lower part of the belly. Sometimes the hemorrhage is strictly internal, proceeding from a wound of one of the visceral arteries, or, it may be, from one of the large vessels of the abdomen. Such an occurrence is always fraught with danger and perplexity.

Incised wounds of the abdomen, other things being equal, bleed less than lacerated and contused wounds. Punctured wounds sometimes bleed profusely, and the same remark applies not less forcibly to gunshot wounds. In the latter, it sometimes comes on secondarily, that is, from the fifth to the eighth day after the infliction of the injury.

However the bleeding may be induced, or from whatever source it may emanate, the only way to arrest it, is to ligate the affected vessel, unless, as may occasionally happen, it be situated favorably for compression; in which case the best instrument for the purpose would be an ordinary truss, the pad of which should be placed directly over the divided parts. When the bleeding is internal, the outer wound should promptly be enlarged, and the artery secured by ligature.

Muscular wounds of the abdomen must always be treated with the interrupted suture, carried down to within a very short distance of the peritoneum, but, of course, not into it. A very firm hold should be taken of the edges of the breach, otherwise, as the connective tissue is both soft and scanty, the thread will be sure to tear itself out long before the completion of the consolidating process. Moreover, the stitches should be placed very closely together. During the subsequent treatment, as well as for many months after the patient begins to walk about, the abdomen should be well supported with a broad, gum-elastic bandage, provided with a flat pad. Unless these precautions be properly attended to, ventral hernia will be inevitable.

#### SECT. VI.—ABSCESSSES WITHIN THE WALLS AND CAVITY OF THE ABDOMEN.

*Parietal Abscess.*—It is not often that abscesses form in the walls of the abdomen. The occurrence is chiefly witnessed as a result of external injury, as a blow or kick, but it is also occasionally noticed as a consequence of inflammation of the bowel from the presence of impacted feces, or of a foreign body. However induced, the symptoms are usually well marked, being such as attend acute inflammation in other parts of the body, only that there is generally more pain and constitutional disturbance. The matter may collect, first, immediately beneath the skin, in the cellulo-adipose substance; secondly, between the layers of the different muscles; and, thirdly, between the muscles and the peritoneum. In the latter case, it is usually of a decidedly stercoraceous odor, owing to the imbibition of sulphuretted hydrogen from the intestinal tube, which is very apt, as the disease advances, to become

adherent to the posterior wall of the abscess. This event often happens even when the bowel retains its integrity, as, indeed, it generally does, however extensive may be the accumulation, its tendency being always to the external surface. Owing, however, to the manner in which the pus is bound down by the muscles and aponeuroses it is a long time in coming to a head.

The *diagnosis* of these deep-seated abscesses is sometimes extremely obscure, especially in their earlier stages. The most reliable phenomena are, the occurrence of rigors, alternating with flushes of heat, the indurated and circumscribed nature of the swelling, the excessive pain and throbbing, and the existence of an erysipelatous blush of the surface, with marked oedema of the subcutaneous cellular tissue. The fluctuation is always very faint, even when the matter is approaching the surface. If the abscess be situated towards the middle line, it may receive an impulse from the aorta, and thus induce a suspicion of the existence of aneurism. Whenever there is any doubt about the diagnosis, recourse is had to the exploring needle.

The *treatment* is, of course, rigidly antiphlogistic; by venesection, leeching, and medicated poultices, along with the frequent application of iodine, and the use of purgatives, nauseants, and anodynes. As soon as fluctuation is perceived, or even before, provided there is no doubt respecting the diagnosis, a free incision is made, patency being afterwards maintained with the tent. If the matter is permitted to remain long pent up, it must necessarily lead to serious structural changes, rendering the cure very tedious.

*Hepatic Abscess.*—Abscesses within the abdomen are usually situated in the liver, their occurrence being quite frequent in warm climates, especially in the East and West Indies. They are also sufficiently common among the boatmen of our Southern rivers. Some years ago, nearly a dozen cases of hepatic abscess, all from Louisiana, were admitted into the Louisville Hospital in less than two months. The matter may discharge itself in different directions; most generally, perhaps, into the peritoneal cavity, where, of course, it promptly excites fatal inflammation, or into a neighboring coil of intestine, into the lungs, or, externally, through the walls of the abdomen. It is only in the latter event that the disease ever calls for surgical interference, and it is evident that an early and correct diagnosis here is a matter of paramount importance. If the case be neglected, or misunderstood, the abscess, giving way, may suddenly burst into the peritoneal sac, and thus destroy a patient, who, under other and more favorable auspices, might be saved. Besides, if the fluid be long retained, it may cause irreparable injury to the hepatic tissues, so that, although it may ultimately find an external outlet, recovery will be impossible.

The most valuable *diagnostic* characters of hepatic abscess are, a severe, gnawing, aching, or throbbing pain in the hypochondriac and scapular regions, marked enlargement of the liver, great embarrassment of breathing, and inability to lie on the left side, accompanied by violent rigors, alternating with flushes of heat, excessive gastric irritability, and a muddy, jaundiced state of the eye and skin. As the matter accumulates and approaches the surface of the organ, it excites

inflammation in its peritoneal covering, causing it to adhere to the wall of the abdomen. The morbid action steadily advancing, ulceration is set up in the superincumbent structures, leading, eventually, after weeks of suffering, to an escape of the fluid, its approach being always preceded by an erysipelatous blush, and by a doughy, œdematous state of the surface.

There are four circumstances in connection with abscess of the liver worthy of special attention.

1st. Care should be taken not to puncture the swelling until there is a well-marked red, purple, or livid spot, with an œdematous state of the skin and cellular tissue, over its most prominent part. If these phenomena be wanting, it may be assumed, as a general rule, that there is no adhesion between the liver and the wall of the abdomen, and, consequently, that, if an opening be made, the matter will inevitably run into the peritoneal cavity, causing fatal inflammation.

2d. When the pus is slow in reaching the surface, and the symptoms are urgent, a free incision should be made over the more protuberant part of the swelling, through the abdominal muscles, but no farther, the object being to excite prompt and efficient adhesion between the contiguous surfaces, by means of a tent carried deeply into the bottom of the wound. As soon as this event has been brought about, the abscess may be opened with entire impunity.

3d. Care should be taken not to confound this disease with chronic distention of the gall-bladder, an accident which has, more than once, been followed by fatal results. The signs of distinction are generally sufficiently clear. In enlargement of the gall-bladder, the tumor is globular, uniformly hard, and situated lower down than in hepatic abscess; in which the swelling is more diffused; more painful, and also more soft, generally fluctuating at its summit, while at the base it is firm and resisting.

4th. The puncture in hepatic abscess should not be direct, but valvular, so as to exclude the ingress of the air, the presence of which is always a source of severe irritation by causing rapid decomposition of the pus. To obviate this effect, the operation should be performed in the same cautious manner as in paracentesis of the chest, with a trocar having a canula furnished with a stopcock and a bladder. The only exception to this rule is where the matter lies just below the skin, ready at any moment to discharge itself.

*Splenic Abscess.*—Abscess of the spleen should be treated upon the same principles as that of the liver. Of this rare disease I have seen only one case, the patient being a young, robust farmer, who suffered immensely for a fortnight. The spleen gradually augmented in volume, and, at the expiration of this period, it projected over towards the umbilicus, forming a large, rounded tumor, between the linea alba and the margin of the ribs. In a short time fluctuation was perceived, and, on introducing a trocar, about three pints of fetid, dark-colored matter issued from the incision. The wound was kept open for several days, by means of a tent; but it soon closed, and thence on, the patient's health began gradually to improve. The disease had supervened upon repeated attacks of intermittent fever, and was charac-



terized by excessive irritability of the stomach, great pain and tenderness, and an impending sense of suffocation, caused, no doubt, by the pressure of the enlarged organ upon the diaphragm.

*Renal Abscess.*—Surgical interference is sometimes demanded on account of abscess of the kidney, the matter pointing in the lumbar or iliac region. Such an occurrence, however, is extremely uncommon, inasmuch as, when nephritis terminates in suppuration, the contents of the abscess usually pass off in some other direction, as the ureter, bowel, or peritoneal cavity. The disease is marked by excessive suffering, both local and constitutional; but as the symptoms which characterize it do not differ materially from those attendant upon abscess of the liver and spleen, no further account of them will here be necessary.

Enormous quantities of serum occasionally collect in the kidney from obstruction of the ureter, and the consequent conversion of the organ into a mere membranous pouch, capable of holding many quarts of fluid, and constituting what is called *renal dropsy*. The tumor thus produced projects at the lumbar region, forming an immense swelling, soft, fluctuating, fixed in its situation, and unaccompanied by discoloration of the integuments, except when, as occasionally, happens, the fluid manifests a disposition to point and discharge itself. The general health suffers greatly, the patient becoming excessively emaciated, and finally sinking from exhaustion. If any doubt exist respecting the diagnosis, recourse is had to the exploring needle. The only chance of relief is tapping, experience having shown that the fluid is not amenable to absorption. When the tumor is multilocular, which, however, is a rare occurrence, it may be obliged to be punctured at several points.

*Iliac Abscess.*—Abscesses are sometimes met with in the right iliac region, the result of disease of the colon, cæcum, or vermiform appendix, brought on by the abuse of purgatives, the impaction of some foreign substance, or external injury. Cases occur where the disease is due to perforative ulceration of the bowel, consequent upon an attack of typhoid fever. The matter, which occasionally collects in large quantities, is generally of an ill-elaborated character, and excessively fetid, owing, apparently, to the absorption of sulphuretted hydrogen from the alimentary tube.

The *symptoms* of iliac abscess are always well marked, being invariably such as characterize the development of phlegmonous abscess in other parts of the body. The local distress, however, is generally more than ordinarily severe, owing to the resistance which the accumulating pus meets with from the surrounding structures. Great constitutional disturbance is present; the rigors are violent and protracted, and the patient is harassed with gastric irritability, want of sleep, and a sense of excessive prostration. As the matter advances, the integuments are elevated into a distinct tumor, exquisitely tender to the touch, and marked by an erysipelatous blush, with an appearance of cedema, both so characteristic of deep-seated abscess. Owing to the manner in which the fluid is bound down, it is seldom possible to detect fluctuation until after the disease has committed severe, if not irreparable, mischief.

The proper *treatment* of this affection is an early and free incision; for, unless the case be met in this way, the matter will be sure to burrow more or less extensively, and may even find vent by the bowel, thus eventually causing a stercoraceous fistule, since, notwithstanding this occurrence, the abscess will ultimately also discharge itself externally. Before the operation is performed, the nature of the disease should always be carefully explained to the patient and his friends, lest, gas and pus escaping, the surgeon should be accused of having wounded the bowel, when the opening has been made by the pressure of the pus, or the ulceration which preceded and caused the abscess.

Finally, there is a form of iliac abscess, which occasionally supervenes upon parturition, coming on within the first fortnight after delivery, in consequence of inflammation of the uterus. It differs from the more ordinary iliac abscess in that the matter is situated lower down towards the anterior superior spinous process of the ilium, or even in the ileo-inguinal region, the fluid extending, perhaps, slightly beneath Poupart's ligament. Very frequently, indeed, the matter is strictly lodged in the pelvis, its starting-point being, perhaps, the broad ligaments of the uterus, the ovary, or the retro-peritoneal cellular tissue.

An abscess of this kind is fraught with danger, the patient being generally worn out by the intensity of her suffering. Occasionally, however, a recovery takes place, the matter eventually finding an outlet at the upper and external part of the groin, near Poupart's ligament, the opening usually remaining fistulous for a long time. Now and then the abscess empties itself into the rectum, vagina, uterus, or peritoneal cavity.

#### SECT. VII.—TUMORS IN THE WALLS OF THE ABDOMEN.

Various morbid growths, benign and malignant, form within the walls of the abdomen, and, although they do not differ from those in other regions, yet they deserve particular attention, from the peculiarity of their situation, and their liability to be mistaken for tumors developed in the cavity of the abdomen. The principal growths in this situation, demanding brief notice, are the fatty, fibrous, and cystic. Malignant tumors of the walls of the abdomen are exceedingly uncommon. Encephaloid and melanosis are the only heterologous formations that I have ever met with here, and they were both easily recognized; the first by the rapidity of its development and great bulk, and the second by its black color, which was distinctly visible under the skin, where the cancerous tubercles were situated.

The *fatty tumor* is not often found in this situation; it may lie immediately beneath the skin, or it may be developed among the muscles. When it occupies the site of the natural outlets of the abdomen, or the linea alba, it may be confounded with hernia, as in the interesting case of Scarpa, in which the illustrious surgeon was induced to perform an operation, under the supposition that his patient was laboring under strangulation of the bowel, when he had merely some colicky pains

and abdominal tenderness. Had due inquiry been made into the history of the case, such a mistake might easily have been avoided.

The diagnostic characters of the fatty tumor are, the tardiness of its growth, its perfect indolence, or freedom from pain, its doughy, inelastic feel, the absence of discoloration of the skin, and the integrity of the general health.

A fibrous, or, more properly speaking, *fibro-plastic* tumor is occasionally met with in the walls of the abdomen. An interesting case of this kind was brought under my notice last winter, at the College Clinic, in a youth of eighteen. When first perceived, thirteen months previously, it was hard and firm, but perfectly movable, and about the size of a pullet's egg, its situation being on the left side, some distance from the umbilicus. Its progress, for several months, was very gradual, but during the last six or eight weeks it had increased rather rapidly, and when the case came under my observation the growth was about nine inches in length, solid, inelastic, almost immovable, free from pain, and without any enlargement of the subcutaneous veins, or derangement of the general health. A curvilinear incision being carried down over the long axis of the tumor, it was found to be placed under cover of the abdominal muscles, which were very much stretched and attenuated, its posterior boundary being formed by the transverse fascia, from which it was obliged to be separated with great care. Its chief supply of blood was derived from a branch of the superficial epigastric artery, which was enlarged and required a ligature. Under the microscope the tumor exhibited all the characteristics of the fibro-plastic tissue, interspersed with colloid masses, of variable size, and of an irregularly oval shape, their contents being, for the most part, composed of granular matter. The recovery from the operation was rapid, and, thus far, there has been no tendency to relapse.

The *cystic* tumor of the walls of the abdomen is very uncommon. In most of the cases that have hitherto been observed, it was deep-seated, lying immediately exterior to the peritoneum. It fluctuates, though usually rather faintly, under pressure, and is capable of attaining so large a bulk as to simulate ascites, or ovarian dropsy. Its contents are of a serous nature. Its progress is very slow and painless, and the patient's health is commonly excellent. These circumstances will generally serve to distinguish this morbid growth from others of a more solid character, but, should any doubt exist upon the subject, it will promptly be dispelled by the use of the exploring needle.

In the *diagnosis* of tumors of the walls of the abdomen, much valuable information may be derived from a careful consideration of the history of the case, and a thorough examination of the parts, the patient lying upon his back, with his limbs well retracted, and the shoulders elevated, so as to cause complete relaxation of the abdominal muscles. The tumor being now grasped with one hand, the fingers of the other may generally be readily insinuated beneath it if it be situated in the abdominal wall, at the same time that it will convey an idea of fixedness, which does not belong to intra-peritoneal growths. If the patient turns upon his side, the tumor will steadily maintain its position; generally, too, there will be a degree of tension in the parts which is



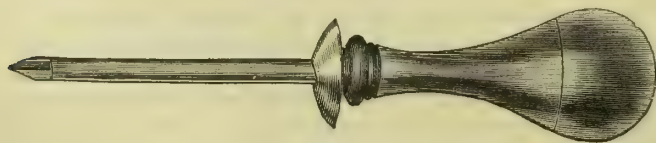
altogether foreign to internal formations and enlargements. In the intra-peritoneal tumor, no matter what may be its character, the growth is originally loose, usually moving or floating about when the patient changes his position in bed; in the intra-parietal, on the contrary, it is fixed. Should any doubt exist in regard to its precise position, and an operation be urgently demanded, an exploratory incision will be the only thing likely to clear up the difficulty.

In the *extirpation* of tumors in this situation, the incision should always be made as much as possible in the direction of the muscular fibres of the abdomen; free use should be made of the grooved director; all bleeding vessels should be tied as soon as they are divided; and unusual pains should be taken to tack together, first, the muscular edges of the wound, and afterwards the integumental, lest, when the parts are healed, hernia should take place. The abdomen should be well protected with long, broad adhesive strips, a compress and a broad bandage, which, when the patient is about to rise, should be replaced by an elastic supporter. By observing these precautions all danger of visceral protrusion will be effectually obviated, however large may have been the wound.

#### SECT. VIII.—ASCITES AND TAPPING OF THE ABDOMEN.

Tapping of the abdomen is required for the removal of dropsical accumulations of the peritoneum and the ovary. As it is, in general, intended merely as a palliative measure, it is never resorted to until the quantity of fluid is so considerable as to occasion great local inconvenience and serious embarrassment of respiration. It may be performed at various points, but the most eligible one is the *linea alba*, midway between the pubes and the navel. The only objection to puncturing the abdomen in this situation is the danger of perforating the urinary bladder, which, when distended, often rises some distance above the pelvis. Any mischief, however, that might be thus induced will be effectually obviated by previous evacuation of the organ. In encysted dropsy, it may be necessary to make the opening at the side of the abdomen; but in doing this there is always danger of wounding the epigastric artery; an accident which has occasionally been followed by fatal results. In ordinary dropsy, the intestines are pushed back by the weight of the fluid, beyond the reach of the trocar. It is only

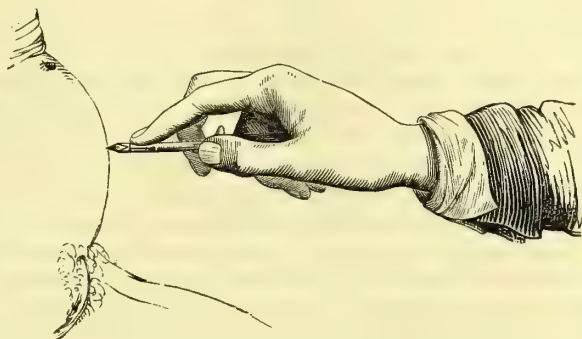
Fig. 416.



when they have contracted adhesions to the interior wall of the abdomen, as might happen when the operation has been repeatedly performed at the same place, that they would be at all likely to suffer.

The only instrument required for this operation is a trocar. In addition to this, however, there should be at hand a broad, flannel bandage, for swathing the belly, and several basins for receiving the water.

Fig. 417.



The patient lies on his side near the edge of the bed, and the abdomen is surrounded by the bandage, the ends of which are crossed behind, and given in charge of an assistant. Holding the trocar firmly in the right hand, with the thumb and index-finger resting upon the canula, the surgeon plunges it into the linea alba, about three inches above the pubes, and by a steady, forcible pressure, pushes it through the abdominal walls. A sudden cessation of resistance and the escape of a few drops of fluid announce the arrival of the instrument in the peritoneal cavity, and serve as a signal for the withdrawal of the trocar. The water issues in a full stream, and the discharge is usually completed in a few minutes. To prevent syncope, so apt to follow the rapid removal of the pressure of the accumulated fluid, the ends of the bandage are gradually tightened by the assistant, which compensates, in some degree, for the loss of support experienced by the diaphragm, the large vessels, and the abdominal viscera. Occasionally the passage of water is interrupted by the intrusion of a piece of omentum, a hydatid, or a mass of lymph within the canula. When this happens, the obstacle should be removed by a director, a large probe, or a female catheter, the latter of which may sometimes be advantageously retained in the abdomen until the discharge is completed. When the operation is over, the canula is carefully withdrawn, and the puncture is closed by adhesive strips, the ends of the roller being pinned firmly over a thick napkin, to afford due support to the parts, and to prevent rapid re-accumulation.

The only accidents at all likely to happen in this operation are syncope and hemorrhage. Of these, the first is to be prevented by a proper tightening of the bandage, in proportion as the water is evacuated, and the second, by making the puncture at the linea alba, where there is no important vessel. It is possible that a copious hemorrhage may occasionally proceed from injury of one of the arteries of the omentum; but such an occurrence must be very rare, and does not, of course, admit of any remedy, since the true nature of the case will

seldom be revealed until after death. Should the epigastric artery be wounded, and the blood issue externally, the opening made by the trocar should be plugged with a bougie, or piece of wood, wrapped with linen. This expedient failing, the vessel is exposed, and included in a ligature.

When the surgeon is called upon to tap a female, especially a young, unmarried one, or one whose husband has long been absent, he should not be too eager to enter upon the undertaking, but assure himself well beforehand that the patient is not laboring under pregnancy, instead of ascites. For want of this precaution, accidents have often occurred, as ludicrous, as they were disreputable. The best way to avoid this "dry tapping," as it has been not inaptly termed, is to institute a careful examination into the condition of the mouth and neck of the uterus, if not also of the nipple, and to auscultate the abdomen, with a view to the detection of the foetal and placental sounds. This precaution will be more particularly necessary, if the patient is in excellent health, and has, withal, a ruddy complexion, phenomena which are never present in well-established ascites. If pregnancy exist, the hand, plunged into cold water, and suddenly applied to the tumor, will generally cause instantaneous motion of the child, thus at once revealing the true nature of the case. The distinction between abdominal and ovarian dropsy will receive special attention in the chapter on the diseases of the female genital organs.

Extra-peritoneal dropsy is occasionally observed, and deserves passing notice. Lieutaud, in his *Historia Anatomico-Medica*, refers to several instances of the kind in which enormous accumulations of water existed between the peritoneum and abdominal muscles, either in one general cavity, or in separate and distinct cysts. In one of the cases the bag contained one hundred and forty pounds of fluid, of a bloody appearance. In the tenth volume of the *American Journal of the Medical Sciences*, Drs. Scott and Reamer have reported the particulars of the case of a woman, aged twenty, who, in repeated tapplings, yielded from fifteen to nineteen gallons and a half of serum at each operation. The disease at length proving fatal, the dissection demonstrated the existence of an enormous reservoir between the muscular and peritoneal coats of the abdomen, filled with water, and complicated with the presence of several large cysts, containing various kinds of substance, both liquid and solid. Were these cases examples of ovarian dropsy, or were they serous cysts developed in the walls of the abdomen?



## CHAPTER XV.

## DISEASES AND INJURIES OF THE URINARY ORGANS.

## SECT. I.—AFFECTIONS OF THE BLADDER.

## MALFORMATIONS.

THE bladder is liable to various malformations, but almost the only one of any surgical interest is extrophy, consisting essentially in an absence of the anterior wall of the viscus, complicated with certain defects of the genital apparatus. The occurrence is much more common in males than in females. Of six cases that have come under my notice, all were males. Of nine cases observed by Mr. McWhinnie, of London, seven were males, and two were females.

The urinary tumor, situated at the lower part of the abdomen, is generally somewhat ovoidal or globular. Its volume is greatly influenced by the age and position of the subject. In the child, it rarely exceeds that of a walnut, while, in the adult, it may be as large as a fist, or a goose's egg. Very small when the subject is recumbent, it becomes quite prominent when he stands up, coughs, sneezes, or exerts himself. The surface of the tumor is of a bright red color, and is constantly covered with mucus, which thus protects it, in some degree, from the injurious impression of the atmosphere. In elderly subjects, the part is sometimes partially invested with a cutaneous pellicle, in consequence of which it is much less sensitive, or irritable, than in infancy, childhood, and adolescence, in which it is generally very tender, and apt to bleed on the slightest touch. The orifices of the ureters, generally situated at the inferior part of the tumor, are usually marked each by a small, conical eminence, from which the urine constantly dribbles, rendering the person uncomfortable to himself, and disgusting to those around him. The distance between the two apertures varies from one to two inches, according to the age of the subject.

The penis, preternaturally short and flattened, is bent backwards, and furnished with an imperfect prepuce. The cavernous bodies, attached below to the ischium, as in the natural state, are small and narrow, and are not always united along the middle line, except just behind the head of the penis. This organ is sometimes imperforate, and at other times it presents a gutter along its upper surface for the lodgment of the lower half of the urethra. When this is the case, the posterior part of the canal displays the verumontanum, the mouths of the ejaculatory ducts, and the orifices of the prostatic canals. From the peculiar conformation of the penis and urethra, the individual is

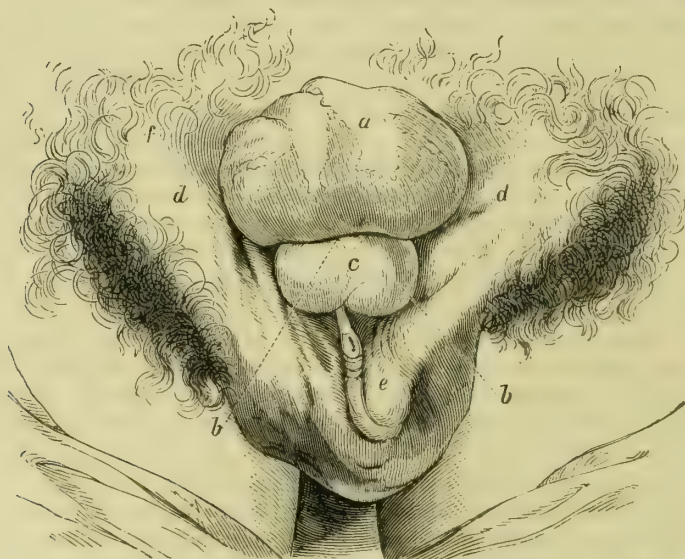
necessarily impotent. The prostate gland exists generally in a rudimentary state. The seminal vesicles are also very diminutive, and are invariably situated behind the inferior part of the tumor. The ejaculatory ducts pursue their natural route, but are unusually small.

The scrotum is sometimes absent; at other times it exists merely in a rudimentary state. In the latter case, it may contain the testicles, while, in the former, these organs are either lodged in the groins, or in a cutaneous bag at each side of the tumor. The testicles are sometimes normal; at other times they are absent, or much diminished in volume.

The bodies of the pubic bones are absent, the pelvis is unusually broad and flat, and the groins are often the seat of hernia.

An excellent idea of the ordinary appearances of this form of malformation may be obtained from an examination of the accompanying drawing (fig. 418), taken from a young man whose case is well known in this country.

Fig. 418.



Extrophy of the bladder. *a*. Everted bladder. *b, b*. Orifices of the ureters. *c*. Penis without urethra. *d, d*. Pubic symphysis. *e*. Scrotum and testis. *f, f*. Congenital inguinal hernia.

In the female, equally important changes are noticed in the genital organs. Thus, the clitoris may be absent, or deviate remarkably from the normal standard; the nymphæ are small and disjoined, and the labia extend from the sides of the tumor towards the anus, without coalescing behind. The uterus and ovaries are either absent, or they exist in a rudimentary state. Sometimes, however, these organs are fully developed, as is shown by the fact that the woman both menstruates and conceives, as in the interesting cases reported by Thiebault and Ayres.

Extrophy of the bladder was, until lately, universally regarded as

utterly irremediable. In fact, all that can generally be done is to palliate suffering by attention to cleanliness, and by the use of a closely-fitting cover of gutta-percha, furnished with a bottle for receiving the urine. When this cannot be obtained, the part must be kept constantly covered with a thick, soft compress, renewed as often as it becomes wet and disagreeable. The skin around may be protected, if necessary, with suet, pomatum, or simple cerate.

It has recently been proposed to establish a channel for the conveyance of the urine from the bladder to the rectum, and, in one instance, the plan has actually been successfully employed, though not without seriously jeopardizing the patient's life. The operator was Mr. Simon, of London. The method consisted in making the ureters open into the rectum; a circumstance which was effected by passing instruments, armed with threads, from the former into the latter, the threads being afterwards retained until the communication was perfected. Violent constitutional symptoms ensued, and for a while the patient was in great danger; but he ultimately recovered, and was able to wear a pad, by which the opening in the abdomen was closed, and the urine forced into the bowel. In a case in the hands of Mr. Lloyd, in which an attempt was made to establish an opening between the bladder and the rectum by means of a seton, the result was still more unfavorable, the man dying in a few days from peritonitis.

Occasionally an attempt has been made to form a cover for the tumor by *autoplasty*, by borrowing the integuments from the adjacent parts, and inverting them, in the hope that the cutaneous tissue may ultimately assume the properties of the mucous, and so adapt itself to the presence of the urine. The flaps are united by suture, and great care is taken during the treatment to protect them from the contact of the water. The extensive wound in the neighborhood should be as well closed as the case will admit of, the bowels should be locked up with morphia, which should also be freely used to allay pain, and the walls of the abdomen should be maintained, throughout, in a relaxed condition. The greatest possible attention should also be bestowed upon cleanliness.

I must candidly confess my want of confidence in this operation, for the very nature of the affection which it is intended to remedy forbids the idea that it can ever be sufficiently successful to compensate the patient for the pains and perils incurred in its performance. The great danger after the operation will be erysipelas, likely to eventuate in sloughing of the flaps; but in addition to this there will certainly be some risk both of peritonitis and empyema, if not also of congestive disease of the lungs. Much of this danger may, of course, be avoided by proper preliminary treatment.

This operation, so far as I know, has been performed only twice in this country. In the winter of 1858, Professor Pancoast resorted to it at the Clinic of the Jefferson College, but, although it was executed with great skill, the edges of the flaps only partially united. Soon afterwards, it was repeated by Dr. Ayres, of Brooklyn, New York, upon a woman, twenty-eight years of age, with results, apparently,



highly gratifying, the cutaneous cover being nearly perfect, and the patient, consequently, much improved in comfort. A full report of the case, illustrated by drawings, has been published by the operator.

#### WOUNDS.

Wounds of the bladder may be incised, punctured, lacerated, or gunshot, according to the kind of weapon with which they are inflicted. From the situation of the viscus, these injuries must always necessarily be complicated with lesion of the soft parts by which it is surrounded, and also not unfrequently with fracture of the pelvic bones.

The best example of an incised wound of the bladder is the incision made in the supra-pubic and recto-vesical operations for stone. In perineal lithotomy, the knife divides the prostate gland rather than the bladder. A good example of a punctured wound is that made by the trocar, for the purpose of drawing off the urine in cases of permanent retention from obstruction of the urethra.

The *symptoms* of this lesion are, the existence of an opening in the lower part of the hypogastric region, the groin, or the perineum; sudden and acute pain in the situation of the affected organ, extending along the urethra, and often accompanied by slight priapism; an escape of urine, or urine and blood, at the external wound; frequent, but ineffectual attempts at micturition; violent tenesmus; and a discharge of blood by the urethra. The system labors under all the effects of violent shock. When the injury is complicated with perforation of the bowel, fecal matter, mucus, bile, or gas, mixed with urine, or urine and blood, may issue both at the external opening and at the urethra. When the pelvic cavity is pierced, the state of collapse, the usual consequence of the accident, is speedily followed by symptoms of peritonitis, of which the patient almost always dies in a few days.

When the bladder is wounded through the perineum or above the pubes, at a point where it is uncovered by serous membrane, urinary infiltration is liable to take place, and the probability of the occurrence will be so much the greater if the external opening is disproportionably small, if the track of the wound is narrow, and devious, and if the organ was much distended at the time of the accident.

*Gunshot* wounds of the bladder, although, perhaps, less fatal than punctured and incised wounds, are always extremely formidable, destroying the patient immediately or remotely, producing extensive mischief among the soft parts, as well as in the pelvic bones, and leading to the formation of abscesses, sinuses, and fistules, which may last for an indefinite period. When the ball is impelled with great velocity, it will be apt to enter the organ at one point, and pass out directly opposite at another, thus leaving two apertures, and either lodging in the neighborhood, or issuing at the surface of the body. If, on the contrary, it move slowly, or be nearly spent, it will be likely to make only one opening, and to be arrested in the bladder, from which it may be discharged by the urethra, or by a fistulous passage; or, what is more probable, it will become incrustated with earthy matter, and thus form the nucleus of a calculus. The lesion is often complicated

with fracture of the pelvic bones, injury of the large vessels, and perforation of the rectum, the small intestines, the uterus, or the vagina. In the former case, serious mischief is sometimes done by the osseous splinters which the ball makes and detaches in its course towards the bladder, and which not unfrequently find their way into the interior of this organ, where they may give rise even to more disastrous consequences than the ball itself. Wadding, pieces of cloth, or portions of the patient's dress, may accompany the ball.

In the *treatment* of a wounded bladder, two prominent indications are presented: first, to prevent extravasation of urine, and, secondly, to guard against undue inflammation. Unfortunately, the first of these accidents often takes place at the moment of the injury, and, consequently, before the surgeon has an opportunity of interfering. The bladder should instantly be evacuated, the patient placed almost semi-erect in bed, and the catheter, which should be of gum-elastic, should be permanently retained, to enable the urine to pass off as fast as it comes down from the ureters. In a word, the organ should be kept constantly empty and contracted for the first few weeks, or until there is reason to conclude that the wound is closed and all risk of infiltration over. The end of the instrument must not be permitted to become clogged, or to rise up in the bladder. Care should also be taken that it does not irritate the mucous membrane, and thereby excite pain and spasm, rendering its presence uncomfortable, if not intolerable. Should the latter result, however, follow, the catheter must be withdrawn, and an attempt made to obviate the danger of distention by its frequent re-introduction.

The development of undue inflammation is to be prevented by the employment of antiphlogistic means, as general and local bleeding, calomel and opium, fomentations, and vesication of the abdomen. Anodynes must be given in full doses, both by the mouth and by the rectum, to allay pain and spasm of the bladder, induce sleep, and diminish the renal secretion. Hardly any drink is admissible; the diet must be very light and bland, and the bowels must be disturbed as little as possible during the first fortnight. Abscesses, the result of urinary infiltration, are to be opened by early and free incisions.

Nothing can be gained by an attempt to extract the foreign body, when the injury has been produced by fire-arms; for the very moment it is inflicted the urine escapes, and the bladder contracts upon itself so as to destroy the relations between the external and internal wounds. If the ball has fallen into the bladder, it may, if not too large, either pass off spontaneously, or be removed with the forceps; should it be otherwise, and severe symptoms be caused by its presence, it must be cut out through the perineum by an operation similar to that of lithotomy. This may be done immediately, or within a short period after the accident, if the ball has entered beneath the pubes, for the reason that the organ will not only be freed thereby of a disagreeable intruder, but also because there will be less risk of urinary infiltration.

When the bladder has been transfixed, or wounded through the peritoneum, the accident inevitably terminates fatally. In view of this event, would it be proper to make an incision through the linea

alba, and sponge out the extravasated fluid? My opinion is that it would, on the ground that it would be much more creditable to a surgeon to perform such an operation, provided it can be done immediately after the injury has been received, than to stand by and see his patient perish from the effects of peritonitis. The only difficulty in the case might be the uncertainty of the abdominal effusion.

#### LACERATION.

The urinary bladder is liable to laceration. When the laceration takes place as a consequence of the inordinate accumulation of urine from paralysis of the muscular fibres of the bladder, hypertrophy of the prostate gland, or obstruction of the urethra, there is always some degree of softening of the different coats of the organ, thus predisposing them to the occurrence. In such a case, any unusual or sudden exertion may produce the effect in question.

But the most common cause of the accident is external violence, and it is worthy of remark, both in a surgical and medico-legal point of view, that it may occur from the most trivial injury. Any force suddenly applied to the hypogastric region, while the bladder is distended, as a smart blow, a kick, or a fall, will frequently suffice to produce it. The accident is liable to occur in females during parturition, in consequence of the pressure of the child's head, when the patient has neglected to empty the bladder.

The accident usually reveals itself by well-marked *symptoms*, both general and local. Violent pain is instantly experienced in the hypogastric region, the face is pale and ghastly, the pulse is small, rapid, and fluttering, the respiration is hurried and difficult, the extremities are cold, and the surface is covered with a clammy perspiration. The patient occasionally falls down in a state of insensibility, and not unfrequently he feels as if something had suddenly given way in his abdomen. In nearly all cases, there is a constant desire to urinate, and an inability to pass a single drop of water. A small quantity of blood often flows by the urethra. These symptoms are soon followed by nausea and vomiting, intense thirst, excessive restlessness, and an expression of great suffering, with swelling and tenderness of the abdomen.

Laceration of the bladder is nearly always fatal. Death usually takes place in from three to six days after the occurrence of the accident. The immediate sources of danger are, hemorrhage, pain, and the poisonous effect which the urine exerts upon the nervous system, generally promptly collapsing the system.

The treatment of this affection must be conducted upon the same general principles as that of wounds of the bladder. Our only reliance is upon the catheter, anodynes, and stimulants.

#### INFLAMMATION.

Inflammation of the bladder, technically termed cystitis, generally begins in the mucous membrane, and presents itself under two varie-



ties of form, the acute and the chronic. Of these, the first is exceedingly infrequent; the chronic form of the malady is, however, sufficiently common, and often entails a vast amount of suffering. Acute inflammation rarely occupies the whole mucous surface of the bladder; on the contrary, it usually occurs in irregular, circumscribed spots, from the size of a twenty-five cent piece to that of the palm of the hand. Any portion of the organ is liable to suffer, but the parts most frequently affected are the neck and bas-fond.

During its progress, the inflammation often spreads from the mucous membrane to the subjacent cellular tissue, and from thence to the muscular tunic. The peritoneal investment is rarely implicated, in any considerable degree, however serious the attack.

The principal *causes* of acute cystitis are, wounds of the bladder, the presence of calculous concretions, rough horseback exercise, the excessive use of stimulating drinks, enlargement of the prostate gland, stricture of the urethra, injury sustained during parturition, and the protracted retention of urine.

The more important anatomical characters of acute cystitis are, increased vascularity, loss of transparency, softening, and deposits of lymph, with alteration of the natural secretion, and discoloration.

Generally speaking, the malady is ushered in by bold and well marked *symptoms*. The first circumstance which usually attracts attention is a dull, obscure, deep-seated pain, or, rather, a sort of gnawing uneasiness, in the region of the bladder, which, rapidly increasing in intensity, soon extends to the neighboring organs. At this early stage, there is little or no constitutional disturbance; or, if there be any, it is manifested by slight chills, alternating with flushes of heat, some thirst, and a little excitement of the pulse. The patient now begins to experience frequent calls to void his urine, which is expelled either in small quantities, or drop by drop, accompanied with violent straining, distressing spasm, and a peculiar scalding sensation at the neck of the bladder, and along the course of the urethra. The hypogastrium is distended, painful, and so exquisitely tender as to render even the weight of the bedclothes intolerable. The limbs are drawn up, and the body bent forward, to relax the abdominal muscles, and relieve the tension of the bladder. The urine becomes thick, ropy, turbid, reddish, or tinged with blood; and the pain shoots along the testicles, groins, upper part of the thighs, and spermatic cord, to the sacro-lumbar region, where it is often almost insupportable. The urine, never entirely expelled, gradually accumulates, and the bladder at length ascends above the pubes into the hypogastric region, forming a globular and elastic tumor, exquisitely sensitive under the slightest touch.

When the disease is fully developed, there is always more or less constitutional derangement, as indicated by the frequency and hardness of the pulse, the anxious countenance, and the coated appearance of the tongue. Nausea and vomiting, with severe precordial oppression, are rarely absent in this stage of the complaint. Sometimes there is complete suppression of the urine.

Some diversity occurs in the symptoms of cystitis, dependent upon

the particular seat of the morbid action. When the neck of the bladder is mainly affected, excessive pain and a sense of weight and fulness are experienced in the anus and perineum, there is obstinate retention of urine, with an incessant desire to micturate, and severe scalding is felt along the urethra. When the anterior wall of the bladder is inflamed, there is great tenderness on pressure and percussion, with a sense of constriction in the hypogastric region. When the inflammation occupies the bas-fond of the organ, the rectum is most apt to suffer, and the patient is harassed with constant straining and tenesmus.

Acute cystitis usually runs its course with considerable rapidity. It seldom continues beyond the sixth or eighth day without terminating in resolution, tending to suppuration, passing into gangrene, or assuming a chronic type.

The leading *indications*, in every case of acute cystitis, are, first, to subdue symptomatic excitement; and, secondly, to quiet local irritation. For accomplishing the first of these ends, the remedies mainly relied upon, in the earlier stages of the complaint, are general and topical bleeding, cathartics, and diaphoretics, aided by an antiphlogistic regimen. The bowels should be early moved by some mild purgative, as castor oil, or sulphate of magnesia, followed by an enema of cold water, thin gruel, or soap and water. If the biliary secretion be deranged, a dose of calomel should be given. All drastic cathartics must be avoided.

As soon as proper depletion has been practised, diaphoretics are indicated, and the one which I have found most useful, is the antimonial and saline mixture, in union with full doses of morphia and aconite. Dover's powder is beneficial where the skin is already soft. If the stomach be irritable, the effervescing draught is preferable to the other diaphoretics. The action of these medicines may be favored by tepid drinks, the warm bath, and hot fomentations to the hypogastrium and genitals. Diuretics, strictly so called, are improper in this affection. When the urine is acrid, high-colored, or very scanty, a small quantity of nitrate of potassa, or spirit of nitric ether, mixed with some demulcent fluid, may be administered, to modify the renal secretion and to allay vesical irritation. In the latter stages of the disease, an infusion of uva ursi and hops, in the proportion of one ounce of the former, and half an ounce of the latter, to the quart of water, proves sometimes highly advantageous.

Among the more important local remedies for arresting cystitis, and tranquillizing the affected organ, are leeching and cupping, anodyne enemata or suppositories, fomentations, and the hip bath. The pain in the back is relieved by cups, either wet or dry, applied to the sacrolumbar region. Certain modifications of treatment are made, according to the nature of the exciting cause of the disease. Finally, should retention of urine occur, no time is to be lost in having recourse to the catheter.

## SUPPURATION AND ABSCESS.

A discharge of pus, or muco-purulent fluid, from the lining membrane of the bladder, although sufficiently common in connection with chronic cystitis, is infrequent as a consequence of the acute form of the disease. The discharge, moreover, is usually of brief continuance, and small in quantity, while in chronic cystitis it often lasts for a long time, and is occasionally remarkably profuse.

The matter, instead of being furnished by the free surface of the mucous membrane, occasionally presents itself in the form of a small *abscess*, situated in the submucous cellular tissue, or between the muscular and serous tunics. It may occur in any part of the viscus, but is most frequently observed at its neck, as a solitary depôt. In the great majority of cases, the abscess points inwards towards the cavity of the bladder, but it may also open into the rectum, the sigmoid flexure of the colon, the ileum, the vagina, or the abdominal cavity. Finally, the matter is sometimes diffused through the cellular tissue of the coats of the bladder, which, in consequence, exhibit a soft, oedematous aspect.

Suppuration of the bladder may be the result of idiopathic inflammation, either acute or chronic, external violence, or the presence of some foreign body, as a calculus, bougie, or catheter. In the latter case, abscesses are generally produced under the influence of protracted irritation, operating directly upon the tunics of the organ.

The occurrence of suppuration is always denoted by well-marked *symptoms*. The most important are frequent rigors, alternating with flushes of heat; an increase of thirst, anxiety and restlessness; the character of the pain, which is dull, aching and throbbing; and a feeling of weight in the perineum. The mind generally wanders, and, in many cases, there is confirmed delirium. These symptoms, however, may be simulated by other diseases, both of the bladder and of the neighboring organs. In abscess, the diagnosis is sometimes determined by the sudden appearance in the urine of a large quantity of pus, after a violent effort at micturition, or an attempt to draw off the urine. Infiltration of pus into the coats of the bladder cannot be distinguished during life.

The *prognosis* of suppuration of the mucous membrane of the bladder is usually favorable; the reverse being the case in abscess. Much, however, must necessarily, under such circumstances, depend upon the nature and extent of the injury.

The *treatment* of this disease is to be conducted upon general anti-phlogistic principles in its earlier stages, and, subsequently, upon the tonic and invigorating plan. If abscesses point externally, they must be opened with the knife.

## GANGRENE.

Acute inflammation of the bladder sometimes ends in gangrene. This mode of termination, however, is fortunately infrequent, as the morbid action which gives rise to it is generally easily arrested by the



early and vigorous employment of antiphlogistic remedies. It is particularly to be apprehended when the cystitis is marked by great violence, when it has been induced by external injury, and when it occurs in old persons, whose health has been much impaired by previous suffering.

Gangrene of the bladder, although it may occur as a consequence of idiopathic inflammation, is almost always a result of external violence or over-distension of the organ from urine. One of its most common causes is compression of the viscus during the passage of the child's head in parturition. Gangrene occasionally follows the operation of lithotomy, and laceration of the mucous membrane consequent upon the employment of instruments.

The occurrence of mortification of the bladder is announced by great prostration of strength; sudden cessation of pain; coldness of the extremities; small, weak, frequent, and tremulous pulse; profuse, clammy, and offensive perspiration; cadaverous expression of the countenance; mental confusion, delirium, and coma; hiccup; twitching of the tendons; and, towards the close, by colliquative diarrhoea and involuntary discharge of the feces. The urine is of a dark brownish, or blackish color, emits a peculiarly fetid, sickening odor, and is effectually retained by the dead, crippled, or paralyzed organ. On dissection, the mucous membrane is found to be of a dark red, livid, or purple complexion, very soft, easily torn, and bathed with a thin, sanious fluid, of an excessively fetid odor.

Gangrene of the bladder is sometimes followed by a rupture of the coats of this organ, and the escape of its contents. This event is most likely to happen when there has been protracted retention of urine, with inordinate distension, and may take place very suddenly, or it may occur slowly and gradually, as a result of ulceration. Whether the urine escape into the cavity of the abdomen, or into the cellular tissue of the pelvis, death is equally inevitable.

The *treatment* of this affection is easily told. The object is to prevent the lesion, rather than to cure it after it has been established. Should gangrene be inevitable, the indication is to support the system, and by means of quinine, ammonia, brandy, opiates, and nutritious food, assist the patient in throwing off the effects of the local disorder. The distension of the bladder is obviated by the catheter.

#### ULCERATION.

Ulceration of the bladder is uncommon. Judging from the results of my own observations, I am disposed to rank it amongst the rarest accidents to which this organ is obnoxious. The ulcers are usually neither numerous nor large. Their most common appearance here, as in the bowels, is that of depressed breaches of continuity of the mucous membrane, of a circular or oval form, with edges slightly elevated. Occasionally, their edges are hard, thick, fissured, and puckered. Appearances like these are most common in old, chronic cases. The bottom of the ulcer is originally formed by the submucous cellular substance; but as the disease progresses it may erode the muscular

fibres, and even the serous investment, leading, perhaps, eventually to perforation, and to the escape of urine into the abdominal cavity. Or, instead of this, adhesions may take place between the bladder and the neighboring viscera.

In the great majority of instances, the ulceration can be distinctly traced to chronic cystitis. Paralysis of the bladder, injury of the spinal cord, and organic lesion of the kidneys, are very apt to induce the affection, from the changes which they create in the composition of the urine. Calculous concretions, and earthy deposits often occasion ulceration solely by the pressure which they exert upon the mucous membrane. Sometimes the disease is the result of the softening of tubercular matter; and in this event the muscular fibres are occasionally as completely denuded, as if they had been dissected with the knife.

The *symptoms* of ulceration of the bladder do not differ essentially, in the early stage of the disease, from those of subacute or chronic inflammation. Even at a later period, they are not always well marked. The most prominent local phenomena, are pain and uneasiness in the pelvic cavity, with spasm, frequent micturition, and an offensive state of the urine. The pain is of an acute, burning, or scalding character. The inclination to urinate is not incessant, but comes on in paroxysms, which gradually increase in frequency, and are attended with intense suffering. The urine is seldom permitted to accumulate to any extent, and is, therefore, generally voided in small quantities at a time. The fluid, which is commonly acid and slightly albuminous, deposits, on cooling, a considerable amount of thick, ropy mucus, and sometimes contains shreds of lymph, or the debris of the affected membrane. In the advanced stages of the complaint, it is excessively offensive, of a dark color, occasionally like coffee-grounds in appearance, and often mixed with pus, and tinged with blood. An ammoniacal state of this fluid is not uncommon at this period. When there is extensive destruction of the lining membrane, very little mucus is seen in the urine.

As the disease progresses, the sympathies and functions of the urinary organs are completely subverted, and the patient's health is materially impaired by the local derangement. Sometimes, however, on the other hand, the symptoms are comparatively mild, and but little distress is experienced in the urinary apparatus. This is more particularly liable to happen when the disease is of a tubercular character.

The *diagnosis* of this disease is difficult, and cannot always be determined during life. The affections for which it is most liable to be mistaken are simple cystitis, catarrh, and stone. From the first, it can generally be distinguished by its obstinate persistence, by the greater extent and violence of the local distress, by the incessant desire to void the urine, by the more frequent recurrence of spasms, by the more severe burning or scalding along the urethra, and, lastly, by the presence of pus in the urine, and, in the more aggravated forms of the complaint, by the absence of mucus. In catarrh, the characteristic symptom is a copious secretion of thick, tough, ropy mucus, with a turbid appearance and an ammoniacal smell of the urine. The local and constitutional distress are less severe than in ulceration, the desire to micturate is not so frequent, there is less sensibility in the urethra,

and there is often complete intermission of the vesical disturbance, the patient remaining comparatively comfortable for days and weeks. In ulceration, the symptoms are persistent, the disease steadily proceeding from bad to worse.

In stone, the pain is most severe immediately after passing the urine, and is generally much aggravated by rough exercise; the urine is more frequently bloody; there is less irritability of the urethra; and the intervals between the paroxysms are longer than in ulceration. If doubt exists, the sound is used, cautiously and gently, lest, if the case be one of ulceration, it increase the local inflammation, and endanger life.

In ulceration there is sometimes a discharge of the debris of the mucous membrane, which never happens in simple cystitis, catarrh, and calculous disorder.

When perforations exist, a discharge of gas, fecal matter, ingesta, and other substances, along with the urine, leaves no doubt respecting the nature of the disease.

The *treatment* of this complaint is most unsatisfactory. At its commencement the means employed to arrest it must be strictly antiphlogistic. Active depletion by the lancet will, however, seldom be called for after the expiration of the first fortnight, while the local abstraction of blood by leeches is proper in every stage of the disorder, and constitutes, indeed, one of our most valuable therapeutic resources. The bowels should be kept in a soluble condition, but active purgation is injurious. The diet should be light, but nutritious, and consist chiefly of bread, toast, potatoes, rice, hominy, and mush, with weak tea at breakfast and supper. The patient should constantly wear flannel next the skin, and carefully guard against sudden vicissitudes of weather. Sexual intercourse, and rough exercise of every description, must be carefully avoided.

Of the internal remedies calculated to act directly upon the urinary apparatus, the most important are, the balsam of copaiba, uva ursi, hops, cubebs, hyoseyamus, the bicarbonate of soda, the mineral acids, and the tincture of the chloride of iron, either alone, or variously combined. Anodynes, in full doses, are indispensable for quieting the bladder, and procuring sleep.

Local remedies, or means addressed directly to the affected surface, are sometimes highly serviceable. The best undoubtedly are such as are of an anodyne character, as infusion of poppy, opium, hop, aconite, and cicuta, or tepid water, either simple or medicated with tar, tannin, sulphate of zinc, creasote, nitrate of silver, and other substances. Lime-water, black wash, and a weak solution of iodine have occasionally proved advantageous. The best mode of introducing them is by means of a gum-elastic bag, carefully adapted to the end of a medium sized silver catheter. The quantity of any injection should not exceed, at first, an ounce and a half. An anodyne injection should be retained as long as possible; an astringent one not more than a few minutes.

Counter-irritation in the form of issue, seton, or pustulation with tartar-emetic, is often advantageous in this affection, and should always be resorted to as early as practicable.



## CHRONIC INFLAMMATION, CATARRH, OR CYSTORRHŒA.

Catarrh of the bladder, technically denominated cystorrhœa, signifies an inordinate secretion of white, glairy mucus, essentially dependent upon chronic inflammation of the lining membrane. It is analogous in its character to gleet, leucorrhœa, and other kindred affections, and is generally merely a symptom of a more serious disease. It may occur at any period of life, but is most common in elderly subjects.

The immediate cause of cystorrhœa is always some obstacle to the evacuation of the urine, or a diseased condition of the bladder. Hence, it is most commonly observed as an effect of stricture of the urethra, of vesical calculus, and enlargement of the prostate gland. Paralysis of the bladder, whether produced by over-distension of the organ by urine, or injury of the spine, frequently gives rise to it. Cystorrhœa is a constant attendant upon sacculation, ulceration, hypertrophy, and carcinoma of the bladder. When the affection is once established, it is easily aggravated or reinduced by exposure to cold, excesses in diet, irritating injections, diuretics, over-distension of the bladder, neuralgia, retrocession of gout, repulsion of cutaneous eruptions, local injury, and disease of the adjoining parts, as the anus, rectum, vagina and uterus.

Cystorrhœa generally comes on in a slow, gradual and insidious manner. The inflammation which accompanies the affection, and which is always the immediate cause of the cystorrhœa, is of a chronic character, and, in the first instance, of a very mild grade. It is for this reason that the term subacute has sometimes been applied to it.

The characteristic *symptom* of the disease, as was before stated, is an inordinate secretion of mucus. This is associated, in nearly all cases, with an altered condition of the urine, frequent and difficult micturition, pain in the region of the affected organ, as well as in the adjoining parts, and more or less constitutional derangement.

The quantity of *mucus* secreted varies remarkably in different cases and under different circumstances. In the incipient stages, and in the milder forms of the affection, it is generally small, not exceeding, perhaps, a few drachms in the twenty-four hours. At a more advanced period, the quantity is often considerable; and in some instances it is truly enormous.

During the progress of the disease the *urine* always becomes highly acrid, so that the bladder can hardly tolerate its presence, even for a few minutes. It generally emits an ammoniacal odor, is rapidly decomposed, both in the bladder and out of it, and is nearly always mixed with purulent and phosphatic matter. If a silver catheter is used late in the disease, it usually comes out of a bronze, brownish, or black color, in consequence of the presence of a minute quantity of sulphuretted hydrogen.

The *pus* which is present in this disease is derived from various sources; sometimes from the bladder, sometimes from the ureters, or the prostate gland, but more generally from the kidneys, which are

often seriously involved in the mischief. Its presence is always to be regarded with great attention, as it is generally indicative of serious disease of the organs from which it is derived. The urine is voided frequently, in small quantity, and with more or less difficulty. Generally it passes off in interrupted jets, in a small, feeble stream, or in drops, accompanied by violent spasm and straining. When the urine is loaded with thick, ropy mucus, the difficulty of voiding it is much increased, and the patient is obliged to have frequent recourse to the catheter.

The *diagnosis* of this disease is always easy. Almost the only affection with which it is liable to be confounded is seminal emission; but this can happen only when the seminal fluid flows into the bladder, and mixes with the urine, in consequence of stricture of the urethra, or enlargement of the prostate gland. The distinction is that, in catarrh, the discharge is always greater and more constant, and also more ropy, tenacious, and offensive, the local suffering is more severe, and there is a more frequent desire to urinate. In seminal disease, the matter is voided in small quantity, and at remote intervals; it has a peculiar odor, is of a light color, and is partially insoluble in water, in which it floats in shreds. When there is any doubt, the best way is to submit a few drops of the suspected fluid to microscopical examination. If it be semen, it will be found to consist of small oblong bodies, with delicate, tapering tails.

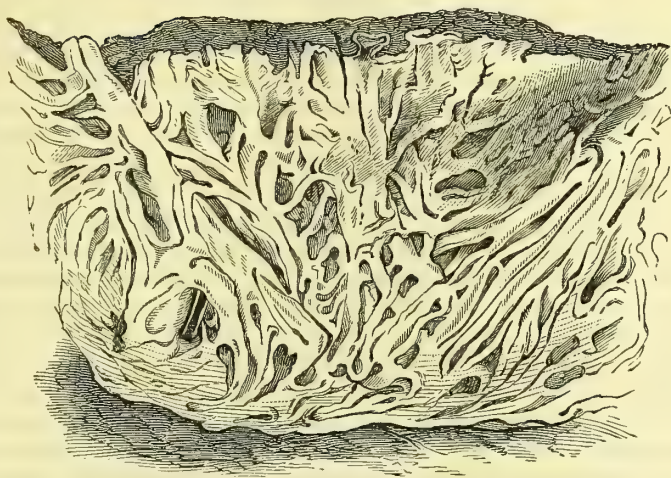
The *prognosis* in cystorrhœa varies with many circumstances which hardly admit of precise detail. Much will necessarily depend upon the age and constitution of the patient, the duration of the disease, and the condition of the bladder and of the associated organs. In its incipient stage it is sometimes not difficult of cure; but when, commencing gradually, it has at length come to disorder the whole system, it rarely terminates favorably.

The *morbid alterations* observed in those who die of this disease are various. In the early stage, and in the milder forms, the mucous membrane usually presents slight marks of inflammation, with little or no lesion of the other tunics. After some time, however, the muscular fibres become hypertrophied, and exhibit the peculiar retiform arrangement delineated in (fig. 419), from a specimen in my collection. Occasionally a large bar-like ridge lies just behind the neck of the bladder, offering a considerable obstacle to the passage of the catheter.

The cellulo-fibrous lamella is also much thickened, as well as increased in density, and the mucous membrane, particularly the portion which corresponds with the *bas-fond* of the organ, is often thrown into large, heavy ridges. In some instances the lining membrane is ulcerated, covered with patches of lymph, or protruded across the muscular fibres, in the form of one or more pouches. The walls of the bladder are frequently from five to ten times the natural thickness. The kidneys, ureters, and prostate gland, are generally implicated in the mischief; sometimes to a fatal extent.

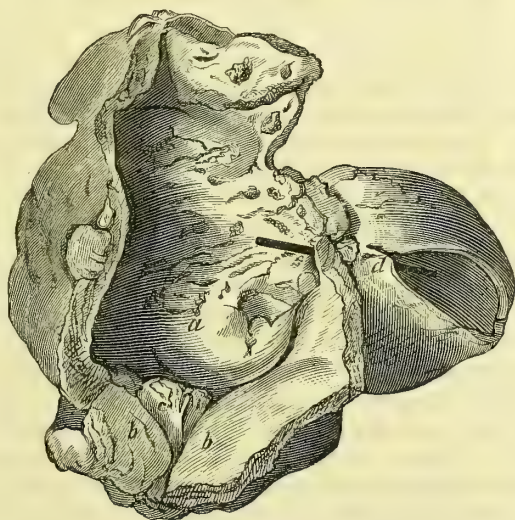
The sacculated appearance of the bladder which so often accompanies chronic inflammation, is well shown in the annexed drawing

Fig. 419.



(fig. 420), from a preparation in my private cabinet. It is formed by a projection of the mucous coat across the hypertrophied muscular fibres, and varies in size, from a pigeon's egg to a cavity nearly as large as

Fig. 420.



Section of the bladder and prostate. *a*. Mucous surface of the bladder. *b, b*. Lateral lobes of the prostate. *c*. Middle lobe. *d*. Large cyst or pouch, partially laid open, and communicating with the bladder by a small orifice.

the bladder itself. It always contains urine, and, occasionally, also calculi.

In entering upon the *treatment* of this affection, it is of great importance to ascertain the nature of the exciting cause. If there be stricture of the urethra, stone in the bladder, hypertrophy of the



prostate gland, or disease of the neighboring and associated organs, it will be imperative upon the practitioner to pursue the respective modes of treatment usually adopted for these several complaints.

It would be useless to repeat here what has already been said in other portions of the work, respecting the employment of antiphlogistics. They are imperatively demanded in all cases attended with violent pain and frequent micturition, even when there is no marked constitutional disturbance. When the lancet is inadmissible, from twenty to thirty leeches may be applied to the perineum and inside of the thighs, or to the lower part of the hypogastric region. The topical bleeding should be followed by the warm bath, warm fomentations, and warm enemata. The bowels must be opened with saline cathartics, or, when the secretions are much deranged, with calomel and jalap. All articles tending to irritate the rectum should be carefully avoided. The most perfect quietude, both of mind and body, must be enjoined; the diet should be as light and inirritant as possible; and the patient should be requested to make free use of demulcent drinks, as gum Arabic water, flaxseed tea, or slippery elm water.

When, by these means, the violence of the disease has been subdued, I know of no remedy so well calculated, in ordinary cases, to ameliorate the morbid condition of the bladder as the balsam of copaiba. It should be given in doses not exceeding ten, fifteen, or twenty drops, three or four times in the twenty-four hours. The best form is that of emulsion. Its nauseating, griping, and purging tendencies should be counteracted by laudanum, or morphia. When the patient is troubled with pyrosis or acid eructations, the medicine may be advantageously conjoined with bicarbonate of soda.

The terebinthinate preparations are sometimes highly beneficial in this affection. The *pareira brava* and *buchu* are articles which have been much extolled in the treatment of catarrh of the bladder, but I have never derived much advantage from them. *Uva ursi* is another medicine which has a specific tendency to the urinary organs. I have found it particularly serviceable in cases attended with excessive morbid sensibility of the neck of the bladder. It may be advantageously combined with *buchu* and *lupuline*, and, in the class of cases just mentioned, with carbonate of soda and potassa.

A combination of some of the articles above mentioned may often be advantageously employed. Indeed, the effect is usually much more conspicuous when they are given in this manner than when they are used separately. I have long been in the habit of administering, with the happiest effect, a combination of *buchu*, *uva ursi*, and *cubebs*, sometimes in the form of an infusion, but more generally in that of a tincture, given several times a day, in conjunction with a small quantity of bicarbonate of soda. Occasionally, a few drops of the balsam of *copaiba*, the tincture of the chloride of iron, or dilute nitric acid, may be advantageously added to each dose of these medicines. The tincture of the chloride of iron, given by itself, sometimes answers an excellent purpose. When the disease is associated with a gouty or rheumatic state of the system, *colchicum* should be employed, and the best form of exhibiting it is in combination with a full anodyne. Benzoic

acid is sometimes used in this disease, and occasionally answers when everything else has failed.

In all cases of vesical catarrh, the urine should be subjected to the usual tests. If it be found to be acid, the carbonated alkalies should be freely exhibited.

To allay pain, and induce sleep, anodynes are indispensable in almost every stage of this disease. They should be given in full doses, either alone or with other medicines.

*Counter irritation*, in the form of seton, issue, or tartar-emetic pustulation, is often highly beneficial in this disease, and should never be neglected in obstinate cases. Blisters, except at the commencement of the complaint, or when there is a sudden aggravation of the discharge, seldom afford much relief. In truth, it is doubtful whether their beneficial effects are not fully counterbalanced by the injurious impression which they sometimes make upon the neck of the bladder, leading to an increase of the local suffering.

The remedies addressed directly to the suffering organ itself, are irrigations, astringent and other injections, and cauterization.

*Irrigation* of the bladder is sometimes employed in the treatment of this affection, and is, in many cases, a valuable auxiliary to the other means already pointed out. It is particularly serviceable when there is an abundant discharge of thick, tenacious mucus, attended with atony of the muscular fibres of the bladder. The operation is performed with tepid water, injected with a large syringe through a double catheter.

Fluids of various kinds, astringent, anodyne, and alterant, are sometimes introduced into the bladder, for the purpose of making a direct impression upon the inflamed surface. The articles most commonly resorted to are alum, zinc, copper, iodine, nitrate of silver, creasote, opium, morphia, laudanum, cicuta, bichloride of mercury, and nitric acid.

*Cauterization* with the solid nitrate of silver is occasionally used. I have made trial of the remedy in a number of instances, but have not derived any decided benefit from it. It is chiefly applicable to those cases in which the catarrh is dependent upon inflammation of the neck of the bladder.

In obstinate cases of cystorrhoea, when all other remedies have failed to afford relief, it has been proposed to penetrate the neck of the bladder by means of an incision, similar to that made in the lateral operation of lithotomy. The object is to afford a free outlet to the mucous secretion as fast as it takes place, and to put the organ thereby into a state of repose. The proposal is plausible, but has not been put sufficiently to the test of experiment to enable us to form an opinion of its value.

Finally, in the management of this affection, the utmost attention must be paid to the *diet*, which should always be of a light, farinaceous character. Between the paroxysms, or when convalescence is fairly established, animal broths, and a little of the lighter kinds of meat, may be used. But neither at this, nor at any previous period, are condiments admissible. Even salt should be employed most spar-

ingly. Vegetable acids, subacid fruits, wine, spirits, and fermented liquors are prejudicial. The best drink is cold water, either alone or with good Holland gin.

Exposure to cold must be carefully avoided. Flannel must be worn next the skin, both summer and winter; riding on horseback must be interdicted; sexual intercourse is to be abstained from; and the bladder must, for a long time, be emptied daily at stated intervals.

When the kidneys, ureters, and prostate gland are seriously affected, no remedy has the power of checking this distressing malady. All that we can advise is perfect tranquillity, a light, but generous diet, anodynes by the mouth and the rectum, the warm bath, and attention to the bowels.

#### IRRITABILITY, OR MORBID SENSIBILITY.

The characteristic symptom of this disease is frequent micturition. The urine is voided every few hours, perhaps, indeed, every few minutes, and the process is commonly attended with more or less pain, spasm, and burning at the neck of the bladder, and along the urethra. The fluid may be perfectly natural, both in its physical and chemical properties; or it may be increased or diminished in quantity, and variously altered in quality. In general, it is acid, high-colored, and surcharged with mucus, of a whitish or grayish complexion. The urethra and the prostate gland are usually unnaturally sensitive to the touch, and a very common accompaniment of the affection, especially in young men, is a tendency to erections and seminal discharges. In time, the general health, perhaps originally good, gradually suffers. The disease is most frequently met with in children and youths of a nervous, irritable disposition. It is also sufficiently common in persons who are predisposed to attacks of gout and rheumatism.

Irritability of the bladder may be arranged under different heads, according to the *causes* by which it is induced, as—1st. Disease of the urinary apparatus. 2d. Altered state of the urine. 3d. Diuretic medicines. 4th. Disorder of the genital organs. 5th. Derangement of the alimentary canal. 6th. Lesion of the brain and spinal cord. 7th. General debility. 8th. Exposure to cold and heat. 9th. Disease of the pelvic viscera.

The *pathology* of this disease is not well understood. The most plausible conclusion, perhaps, in the absence of facts, is that the complaint consists in an exaltation of the nervous sensibility of the mucous membrane, similar to that which is occasionally witnessed in the retina, the fauces, urethra, and other mucous canals. When the disease depends upon local causes, as stone in the bladder, stricture of the urethra, or enlargement of the prostate gland, the anatomical changes are more distinct, and afford a more satisfactory solution of the real nature of the case. Very frequently the irritability is purely sympathetic.

The *prognosis* is variable. The idiopathic form of the complaint, although frequently very obstinate, generally, after a time, yields to a well-directed course of treatment. When the disease occurs in weak, scrofulous subjects, it is always remarkably intractable. The irrita-



bility of the bladder of young children, attended with nocturnal incontinence of urine, sometimes disappears spontaneously towards the approach of puberty. When dependent upon local causes, of a curable nature, relief may generally be obtained.

In the *treatment* of this complaint, so Protean in its character, a strict inquiry should, in every instance, be instituted into its origin, and the practice be regulated accordingly.

When the irritability depends upon congestion or inflammation, the application of leeches to the perineum, the hip-bath, and, in plethoric subjects, venesection, are indicated. Purgatives, rest, low diet, the internal use of balsam of copaiba, anodyne injections, and demulcent drinks, should not be neglected.

If the disorder depend upon an acid state of the urine, alkalies will be indicated, and the one which I usually prefer is the bicarbonate of soda, either alone, or in union with the bicarbonate of potassa.

If the patient be of a rheumatic or gouty habit, colchicum will be useful, especially if it be given in combination with morphia and spirit of nitric ether. The best form of exhibition is the wine, in the dose of one drachm every night at bedtime.

When the disease has been induced by the improper employment of diuretics, a discontinuance of the remedies, demulcent drinks, the hip-bath, hot fomentations, and a full anodyne by the mouth or rectum, will, in general, put a speedy stop to it.

All venereal excesses must be abandoned, and means taken to improve the disastrous effects produced by them. Of these, the most important are quinine and the chalybeate tonics, blue mass and rhubarb as a purgative, a light, but nutritious diet, cold ablutions, the cold shower bath, and exercise in the open air. If spermatorrhœa be present, nothing short of cauterization will be likely to answer. In this form of irritability of the bladder, good effects sometimes result from the exhibition of bromide of potassium, in doses from five to ten grains three times in the twenty-four hours.

When the irritation has arisen from disorder of the digestive organs, particular attention should be given to the correction of the secretions; the diet should be carefully regulated, and the bowels should, from time to time, be duly evacuated. If symptoms of worms be present, anthelmintics are indicated, of which calomel, spirits of turpentine, and chenopodium are the most valuable. In those forms of the complaint which are dependent upon the presence of piles, ulcers, fistule, and other organic changes of the rectum and anus, there can, of course, be no hope of relief without striking at the root of the evil. Tumors must be removed, ulcers cauterized or incised, and sinuses laid open.

Lesion of the brain and spinal cord, leading to irritability of the bladder, must be treated upon general principles.

In that variety of vesical irritability which is so common in young girls, at or soon after the age of puberty, and which is probably of a mixed character, depending, perhaps, partly upon spinal irritation, and partly upon disorder of the uterine functions, much benefit will be derived from a proper regulation of the bowels, chalybeate tonics, particularly Griffith's mixture, Plummer's pill, the shower bath, and

daily exercise in the open air. In protracted cases, the uterus should be examined, as the cause may depend upon displacement of that organ.

When the disease depends upon general debility, the patient must be put upon an invigorating diet, nutritious drinks, and tonics.

If the disease has been induced by cold, and the patient is robust and plethoric, venesection, carried to syncope, will generally afford prompt relief, especially if it be aided by diaphoretics, such as a combination of antimony and morphia, or Dover's powder, brisk cathartics, anodyne injections, and hot fomentations.

The neuralgic form of the disease is best controlled by quinine, strychnia, and arsenic, in union with morphia and aconite. Sometimes prompt relief is afforded by wine of colchicum.

#### NEURALGIA.

Neuralgia of the bladder is a nervous affection, characterized by severe suffering, which is generally referred to the neck of the organ, and is distinctly paroxysmal in its attacks, recurring daily or every other day, about the same period, generally early in the evening or towards morning. The attacks vary in their duration from two to six hours, and the suffering is often of the most racking and agonizing nature. The pain is reflected to the neighboring parts, and is accompanied with a sensation of heat and burning in the urethra, with a frequent desire to pass water, the urine being thrown out in jets, or in a small, and, perhaps, interrupted stream. The paroxysm gradually goes off, leaving no other inconvenience than a feeling of soreness or aching in the neck of the bladder, perineum, and posterior part of the urethra. The general health eventually becomes affected. In obstinate cases there is also a thin, gleety discharge, with great soreness in the perineum and hypogastric region. The urine is almost always natural.

The *diagnostic* signs are not always very distinct. The attacks, especially when very severe, bear the closest resemblance to the paroxysms produced by calculous concretions. Hence, in doubtful cases, sounding of the bladder is advisable.

Of the *causes* of vesical neuralgia very little is known. In general, indeed, they are wholly inappreciable. The disease is observed, for the most part, in persons of a nervous temperament. Venereal indulgences, masturbation, stricture of the urethra, stone in the bladder, and organic disease of the uterus, are all capable of producing it. What influence miasm may exert upon its development is not ascertained, but it is doubtless a very frequent cause of the complaint.

Vesical neuralgia, although an exceedingly painful and distressing disease, seldom terminates fatally. Its long continuance, however, or its frequent recurrence, may render the patient miserable for life.

The *treatment* must be regulated by the nature of the exciting cause. When it is connected with an inflammatory state of the system, prompt and efficient blood-letting is the proper remedy, especially at the commencement of the attack. Purgatives are particularly useful when the affection is dependent on the effects of miasm, and should be adminis-

tered in doses adequate to procure free evacuations. If the tongue is much coated, the best article will be calomel, followed by castor oil. A blue pill, given every other night, after this, will serve to keep the bowels in a laxative condition.

When the disease is plainly of a miasmatic character, the most suitable remedy is quinine, administered in doses of five grains every five hours, until twenty grains have been taken. It should then be discontinued until the next day, when it should be resumed, and persevered in until the same quantity has been used. By this time the paroxysm will usually have abated very much in violence, if not altogether subsided. When the disease has been thus moderated, the best medicines to eradicate it are arsenic, strychnine, and aconite, in union with morphia.

During the violence of the paroxysm, large doses of narcotics are frequently indispensable. Of these, the most efficacious are the salts of morphia, either alone, or combined with nauseants, and tincture of aconite, according to the state of the vascular system. An emetic of ipecacuanha at the approach of the attack, will sometimes cut it short. Much benefit will also accrue, in many cases, from the use of the warm bath. In persons of a gouty, rheumatic habit, no remedy will be so likely to be successful as colchicum.

In the more aggravated and intractable forms of the malady, recourse must be had to counter-irritation over the perineum, the supra-pubic region, the sacrum, or inner part of the thighs. The best forms are the moxa and the caustic issue.

When the neuralgia depends upon stricture of the urethra, foreign bodies in the bladder, hemorrhoids or other disease of the anus, none but the most transient amelioration can be expected from any mode of treatment, until these causes have been removed.

The strictest attention should be paid to the diet. Everything calculated to disorder the digestive apparatus, and induce acidity and flatulence, should be avoided. When indigestion prevails, the carbonate of soda may be resorted to, either alone, or, what is better, combined with some of the simple tonics, such as columba, gentian, hop, or cascarrilla, in infusion. Occasionally, great relief follows the use of large doses of subnitrate of bismuth.

Exposure to cold is avoided; flannel is worn next the surface; sexual intercourse is abstained from; and all sources of irritation are removed.

#### PARALYSIS.

Paralysis of the bladder may arise from various causes, some of which are seated in the organ itself, others in the cerebro-spinal axis, and others, apparently in the mind. Thus, the organ is often palsied by external injury, as a blow or kick upon the hypogastrium, or the pressure of the child's head in parturition; inflammation of its different tunics; or over-distension of its muscular fibres from protracted retention of urine. Compression of the brain and spinal cord is always followed by loss of power of this organ. Want of tone in the general system may induce the disease, as is so often witnessed during the



progress of encephalitis, apoplexy, and fever, especially typhoid. The bladder first loses its sensibility, in consequence of which the urine ceases to make its accustomed impression, and continues to accumulate, without awakening any desire to evacuate it, until the muscular fibres become so much stretched that they are incapable of fulfilling their office.

Severe injuries, amputations, the ligation of hemorrhoidal tumors, and various other operations, are liable to be followed by transient paralysis of this organ. Lying-in females are often unable to pass their urine for several days after delivery.

There is a form of paralysis of this organ to which the term *senile* may be applied. It is most common in elderly men who have led a life of indolence and inactivity, who have indulged freely in the pleasures of the table, and who have habitually neglected the calls of nature. The paralysis usually comes on in a slow, stealthy manner. One of the first symptoms which attract attention is a slight difficulty in starting the urine. As the disease advances, the muscular contractility is still further impaired; and the water, instead of being ejected in a bold, full stream, falls between the patient's leg, and upon his shoes.

As soon as the bladder has lost its power of contraction, its contents accumulate and distend its walls. The organ gradually rises above the pubes, forming a tumor which sometimes reaches as high as the umbilicus, and as far outwards as the brim of the pelvis. The swelling is of an ovoidal shape, fluctuating, indolent at first, but painful afterwards, and attended with complete retention, which constitutes one of the characteristic symptoms of the disease. The duration of the paralysis varies from a few hours to several weeks, months, and even years. Occasionally it ceases only with life. When the paralysis is produced by injury of the spinal cord, the urine is usually highly alkaline, turbid, of an ammoniacal odor, and surcharged with thick, ropy mucus. Phosphatic matter soon makes its appearance, and the lining membrane speedily becomes inflamed, if not ulcerated, followed by a discharge of blood and pus. Persons thus affected are very prone to calculous diseases.

The *prognosis* of vesical paralysis will depend upon the nature of its causes, the character of the treatment, and the age of the patient. If the bladder has been very greatly and protractedly distended, it will necessarily be a long time in recovering its former vigor, if, indeed, it ever does.

It must be obvious that an affection depending upon so many and such opposite causes, must require, for its removal, a variety of modes of *treatment*.

In every case of this disease, the urine should be drawn off at least three times a day. Occasionally the catheter may be constantly retained, especially when there is a good deal of pain and spasm of the neck of the bladder, with a frequent desire to pass water. When the accumulation is very great, and has continued for several days, it is a good rule not to evacuate all the fluid at once. The use of the instru-

ment should be discontinued as soon as the organ has regained its expulsive power.

Another indication, in this disease, is to impart tone to the bladder. For this purpose, various remedies may be used. A brisk cathartic, consisting of calomel and jalap, will often produce the most prompt and happy effect, and should be one of the first remedies that should be administered after the bladder has been relieved of its burden. The medicine may be repeated, in small doses at first, every other day, and afterwards twice a week.

*Emetics* are sometimes of signal benefit in this disease. They are particularly valuable when the paralysis is coincident with disorder of the digestive organs, and torpor of the general system. They are contra-indicated in the traumatic form of the disease.

After the bowels have been well evacuated, and the secretions restored, recourse may be had to remedies calculated to make a more direct impression upon the nervous system. At the head of this class of agents may be placed strychnine, cantharides, and arnica. An excellent formula, when they are given in combination, is the twenty-fourth of a grain of strychnine, a twelfth of a grain of cantharides, and from three to five grains of the extract of arnica, three times in the twenty-four hours, care being taken to watch the effect. If spasmodic twitchings ensue, the patient suffer from strangury, or the stomach become irritable, they are to be regarded as an evidence that they have been carried far enough, or that some modification should be made. In paralysis of the bladder, consequent upon typhoid and other fevers, masturbation, and general exhaustion, few remedies are so serviceable as arnica.

Strong testimony has recently been published in favor of the ergot of rye in the treatment of this affection. The dose usually given, in the twenty-four hours, was from one to two scruples of the recent powder. Dr. Day, of London, generally administers it in the form of a very strong tincture, prepared with six ounces of the substance to a pint of spirit, the dose being a drachm three times a day, in an effervescing draught of citrate of ammonia. The fluid extract is also a convenient method of administration.

In the inflammatory form of the disease, characterized by pain and spasm of the neck of the bladder, with a constant desire to urinate, and more or less febrile commotion, the treatment should be conducted strictly upon antiphlogistic principles.

When the disease is associated with general debility, tonics are indicated. Ordinarily, a preference is given to the chalybeate preparations, combined, if necessary, with strychnine, cantharides, arnica, and other articles.

In *hysterical* paralysis, the mind is affected rather than the bladder. The want of power is, no doubt, sometimes real, but oftener it is feigned. Such cases are always promptly relieved by assafoetida, valerian and morphia, aided by the catheter. These remedies, however, are merely palliative, not radical. To effect a permanent cure, the treatment should be directed to the improvement rather of the mind and of the general health than of the condition of the bladder.

*Counter-irritation* is a useful auxiliary to the other remedies. A succession of blisters over the dorso-lumbar region often proves highly beneficial, by stimulating the spinal cord. The vesicated surface may be sprinkled over the space of about the size of a dollar, with the fourth of a grain of strychnine. The application may be repeated every twelve hours.

I am not partial to pustulation with tartar-emetic ointment, but this mode of counter-irritation is occasionally advantageous. With the moxa I have no experience in the treatment of this affection.

The actual cautery is a much more energetic and suitable agent, especially in the more rebellious forms of vesical paralysis. The best place for applying it is about the junction of the last lumbar vertebra with the sacrum; in traumatic cases, however, depending upon injury of the spine, it ought sometimes to be used much higher up. The cautery which I generally employ for this object is fully one inch in diameter.

Counter-irritation by seton is hardly to be recommended in any case. Frictions over the perineum and hypogastrium, with stimulating embrocations, such as turpentine and ammonia, are sometimes serviceable.

Another remedy of great potency, in many cases of this disease, is the *cold douche*. It is a most powerful stimulant, and sometimes rouses the dormant energies of the bladder when almost everything else has failed.

Finally, *galvanism*, as a local stimulant, should not be neglected. It is particularly indicated in senile palsy, attended with a partial failure of the muscles of the lower half of the body.

No very satisfactory observations have yet been made in regard to direct medication in the treatment of vesical paralysis. Paul of Ægina, and some modern practitioners have advised astringent injections; and Deschamps states that he cured several cases with injections of cold water. In a very obstinate case, which resisted every known method of treatment, both general and local, for ten weeks, a cure was speedily effected by injections of strychnine.

#### RETENTION OF URINE.

The symptoms of retention of urine are generally well marked, even at an early stage of the complaint. In this respect, however, there is, as might be supposed, considerable diversity in different cases, depending mainly upon the natural tolerance of the bladder, and the character of the exciting cause of the disease. In paralysis of the muscular fibres of the organ, attended with loss of sensation, the accumulation may make great progress, and yet the individual not be aware of his real condition. A slight discharge of urine, perhaps, occasionally takes place; or if, as often happens, incontinence is soon superadded to the original disorder, the fluid dribbles off incessantly, and thus both patient and physician are lulled into a false security. When, on the contrary, the retention is inflammatory, more or less pain, and frequent inclination to void the urine, with inability to do so, attend the complaint, and at once expose its true nature.



The characteristic *symptoms* of this affection are, the existence of a hard, pyriform, circumscribed tumor, corresponding with the middle line, more or less tender on pressure, fluctuating, not affected by change of posture, and gradually increasing in volume; a frequent desire to void the urine, which, if passed at all, is discharged in drops, or small jets, never in a full stream, or in any considerable quantity; uneasiness and a sense of weight in the pelvic region, soon followed by pain and spasm; straining, forcing, or tenesmus at every attempt at micturition; at first absence of fever, and then rigors, alternating with flushes of heat, and, in the latter stages of the complaint, excessive restlessness, an indescribable sense of oppression, urinous breath and perspiration, typhomania, and a Hippocratic condition of the countenance. In addition to these signs, which none but a heedless practitioner can mistake, there is also generally, after the first few days, a constant dribbling of urine, and the distended bladder can easily be felt by the finger in the rectum or the vagina.

In ascites, with which this affection is most liable to be confounded, the abdominal tumor is diffused, not circumscribed, and changes its form and situation with the position of the body; there is little, if any, tenderness on pressure and percussion; the sense of fluctuation is more distinct; the progress of the disease is more tardy; the urine, although more scanty than in health, is voided several times in the twenty-four hours, generally without pain or difficulty; there is commonly anasarca of the lower extremities; the skin is remarkably dry and harsh; and there is usually an absence of febrile disturbance and always of typhomania, and urinous perspiration.

The *treatment* of retention of urine is, in the first instance, by the catheter; for the indication is to relieve the distended organ without delay, before the part and system have sustained serious mischief. When there is great distention, amounting to several quarts, it will be most safe, as a general rule, not to empty the bladder completely at a single operation, but gradually. The catheter is introduced, and half the fluid is evacuated, to afford the overstretched fibres an opportunity of contracting and regaining their power. Some hours afterwards the instrument is again used, and the remainder of the urine is withdrawn. When this precaution is neglected, or unavoidable, the abdomen should be supported by a compress and a broad roller. A large opiate should be given just before or immediately after the operation, if not contra-indicated by cerebral oppression.

Retention of urine may be produced, 1st, by mechanical obstruction; 2d, by paralysis; 3d, by spasms; 4th, by inflammation; and 5th, by the presence of some pelvic tumor. Finally, it may depend upon the effects of miasm.

1st. The first class of causes may affect either the urethra, the bladder, or the head of the penis.

a. The *urethra* may be obstructed by an organic stricture, a calculous, a small tumor, clotted blood, coagulating lymph, or inspissated mucus. A catheter, bougie, or other foreign body may break off in the canal, and thus become an impediment to the egress of the urine.

In organic stricture, the ordinary means are resorted to; when these fail, our only resource is puncture of the bladder.

An impacted calculus may, in general, be pushed back into the bladder, or extracted with the urethra-forceps. When these means fail, it is removed by incision. Pieces of bougie, and other foreign bodies, are managed on the same principle. Clotted blood, coagulated lymph, and inspissated mucus, are easily displaced by the catheter, or forced out by the urine. When the sides of the urethra are glued together by adhesive matter, the obstacle can only be overcome by the gentle use of the instrument.

The retention is sometimes occasioned by congenital occlusion of the urethra, of which there are several varieties. However induced, or in whatever form it may present itself, the obstruction is almost always easily overcome by the knife, aided by the catheter; or, when the occlusion is owing to simple narrowing of the canal, a cure may be effected by the steady and judicious use of the bougie. Retention in the female is occasionally caused by maldirection of the urethra.

The obstacle may lie exterior to the urethra, as an abscess in the perineum, or a deep-seated collection of blood, an effusion of lymph, or the presence of a malignant tumor. Cancer of the penis and contusions of the perineum are frequently followed by the worst forms of retention of urine.

When the obstacle is seated externally, and bulges inwards, so as to occlude the canal, the knife supersedes the catheter. Extravasated blood is to be treated by sorbefacients, by the application of acetate of lead, hydrochlorate of ammonia, or spirituous embrocations. In contusions of the perineum, without rupture, the catheter is to be used; but when the accident is attended by laceration, a large incision is made, to save the tissues from urinary infiltration.

b. In the second place, the obstruction may be seated in the *bladder*. Of this class of causes, the most frequent are hypertrophy of the prostate gland, coagulated blood, inspissated mucus, lymph, and urinary concretions. The gravid uterus, or any other pelvic tumor, may, by compressing the neck of the bladder, give rise to a similar effect.

The most common form of obstruction of the bladder, productive of retention of urine, is hypertrophy of the *prostate gland*. The hypertrophy may involve the entire organ, or may be limited to one of its lateral lobes, or even to its mammillary process.

Retention of urine, dependent upon enlargement of the prostate gland, is usually of a temporary character, but is liable to be produced by the slightest exposure to cold, irregularity of diet, horseback exercise, sexual indulgence, or neglect to empty the bladder.

The treatment is by the catheter; and one of silver is far preferable to one of gum-elastic. It must not be too abrupt in the curve, and should be at least ten inches and a half in length, otherwise it may fail to reach the distended reservoir. When the instrument comes in contact with the enlarged gland, the surgeon introduces the left index-finger, well oiled, into the rectum, and placing it against its beak, he guides it into the bladder, by pushing it gently towards one side,

or upwards towards the pubes, at the same time that he urges the handle on with the right hand. In order to empty the bladder entirely, it is necessary, as the point of the catheter cannot reach the cavity behind the gland, to raise the patient's hips, or to turn him on his belly, so as to force the urine out of its hiding-place.

Retention of urine from *coagulated blood* in the bladder is a very serious affair. When the quantity is very large, relief must be sought by an opening in the perineum, similar to that in lithotomy. Under ordinary circumstances, however, evacuation is attempted by a full sized silver catheter, with four large eyelets, aided by injections of warm water, and an exhausting syringe. The usual hemostatic means are also employed. When the blood has been recently effused it is best to wait from six to ten hours, until the fluid has subsided to the bottom of the bladder, when the urine may generally be withdrawn without difficulty.

Retention, caused by inspissated *mucus*, coagulating lymph, worms, or calculous concretions, is, in general, easily relieved by the catheter. When it depends upon the presence of the gravid uterus, it can only be remedied by rectifying the position of the displaced organ.

Retention of urine is sometimes occasioned by pressure of the rectum upon the neck of the bladder. Anything having a tendency to cause inordinate distention of the bowel may produce such a condition.

c. Retention of urine may be occasioned by an imperforate prepuce. When this is the case, relief is sought by a free incision. In the female, the obstruction is sometimes caused by fleshy excrescences in the orifice of the tube. Excision is, of course, the proper remedy.

d. Retention may depend upon *priapism*, induced either by inflammation of the penis, by excessive cerebral irritation, as in lesion of the brain, or by the inordinate use of cantharides. However this may be, recourse is at once had to the catheter, attention being afterwards paid to the removal of the exciting cause.

2d. Retention of urine from *paralysis* is of frequent occurrence. The most common causes of this condition of the bladder are, apoplexy, injury of the spine, over-distention of the organ, the effects of fever, contusions, lacerated wounds, and capital operations.

The use of anodynes, in large doses, will sometimes induce temporary paralysis of the bladder. In low fevers, especially when delirium is present, in compound fractures and dislocations, in lacerated wounds, in contusions of the abdomen, and in strangulated hernia, frequent inquiry should be made into the condition of the bladder, in order to guard against retention, or to relieve it speedily, if it be found to be unavoidable.

The liability of this form of retention to be followed by incontinence, cannot be too forcibly or too frequently urged upon the mind of the reader. It is to this form of the affection that I have applied, in my Treatise on the Urinary Organs, the term *incontinence of retention*, in the hope that, by an antithetical expression, I might be able to attract to it the particular attention of medical men.

Retention from paralysis is relieved by the catheter, and it is better



to introduce the instrument frequently than to permit it to remain. When the return of contractility is slow and imperfect, our chief reliance must be upon gentle, but steady purgation, the internal use of strychnine, cantharides, and tincture of the chloride of iron, the cold shower bath, vesication of the sacro-lumbar region, and irritating frictions to the spine. When the loss of power is dependent upon the use of anodynes, cold applications to the head, the hypogastrium, perineum, and genitals will usually suffice to afford relief.

Retention of urine from paralysis of the bladder, whether induced by traumatic or internal causes, often ceases very suddenly of its own accord, or under the use of mild remedies.

Under this head may be noticed a variety of retention of urine, which is occasionally met with in *hysterical* females, and which seems to be dependent rather upon a deficiency of volition than upon paralysis of the muscular fibres of the bladder. The affection is, in general, only temporary, but may last for several days or weeks. Purgatives, assafoetida clysters, and the internal use of antispasmodics, are the remedies mainly to be relied upon. Cold water, poured upon the sacro-lumbar region in a continuous stream, from a height of three or four feet, often affords speedy relief. The catheter must, if possible, be avoided. Moral treatment is often the most successful. Too much kindness will only tend to prolong the case.

3d. Retention of urine from *spasm* of the neck of the bladder or of this organ and of the urethra, is commonly produced by cold, suppression of the cutaneous perspiration, the irritation of ascarides, hemorrhoidal tumors, stone in the bladder, disorder of the digestive apparatus, the use of fermented, vinous, or alcoholic drinks, and the effects of cantharides. The warm bath, hot fomentations, and the inhalation of chloroform, followed by the free use of camphor and morphia, or morphia alone, either by the mouth or rectum, generally afford prompt relief. Cold applications sometimes answer better than warm. When the symptoms are urgent, recourse is had to the catheter.

4th. Retention of urine may be produced by *inflammation* of the urethra and the neck of the bladder. The symptoms are a frequent desire to urinate, with an inability to pass more than a few drops of water at a time; a sense of smarting, burning, or scalding in the urethra and the head of the penis; violent straining; a feeling of weight about the anus; and throbbing in the perineum. Occasionally the urine is mixed with blood and pus.

The *treatment* is, of course, antiphlogistic. Spasm is allayed by anodyne enemata and mucilaginous drinks. General and local blood-letting is to be used. The warm bath is eminently useful. The bowels are moved by mild laxatives. When the symptoms are urgent, and the means here indicated are inefficacious, the catheter must be used, but with great care and gentleness. In inflammatory retention of urine, accompanied by spasm of the bladder and urethra, prompt and decided relief is occasionally obtained from the inhalation of chloroform.

5th. Retention of urine may, in the fifth place, depend upon the presence of a *pelvic tumor*. The difficulty may arise from a serous,

bloody, or hydatid cyst between the bladder and the rectum. Inordinate distention of the bowel by hardened feces, and displacement of the uterus, especially retroversion of the organ, may also produce it. Retention occasionally takes place during utero-gestation and parturition. The *treatment* in these cases is sufficiently obvious.

Finally, there is a form of retention of urine which may be said to be *periodical* in its character, as it comes on at a particular time, very much like an attack of intermittent fever, being evidently dependent upon similar causes. It is met with chiefly, if not exclusively, in miasmatic regions. The treatment must, of course, be by quinine, either alone, or in union with arsenic, and other anti-periodic remedies.

## CATHETERISM.

The introduction of the catheter, although apparently very simple, is one of the nicest and most delicate processes in surgery. It requires skill of the highest order, as well as the most intimate knowledge of the anatomy of the urinary organs. My conviction is that few men perform the operation well.

Catheters are cylindrical tubes, varying in their composition, size, and shape. The best are made of silver, and are, for an adult, about nine inches and a half long, by two lines and a half in diameter; they are perfectly smooth, light, and bent for one-third of their length, to accommodate them to the natural curvature of the urethra. The vesical extremity, which is rounded off, but closed at the point, and nearly of the same thickness as the rest of the instrument, has an oval hole on each side, a quarter of an inch long, and about a line in width, for the entrance of the urine (fig. 421). Instead of this arrange-

Fig. 421.



Fig. 422.

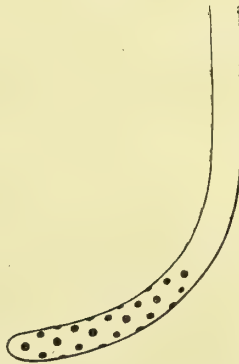


Fig. 423.



ment, this part of the tube is sometimes pierced with numerous little apertures (fig. 422), but these are objectionable, because of their liability to become clogged with blood and mucus. For the removal of urine, mixed with these substances, I have recently had a catheter constructed with eight eyelets. The other extremity, usually called the handle of the instrument, is open, and is provided on each side with a

small ring, for securing it in its place when it is necessary to retain it in the bladder. The French pocket catheter consists of two pieces, united by a screw, and is adapted for either sex. The gum-elastic instrument, so much lauded by some practitioners, I seldom employ. It is very liable to bend whenever it meets with the slightest resistance, and is also very easily injured by the urine. Nevertheless, it may occasionally be employed with advantage, especially if it be rendered firm by the stylet. Every practitioner should have an assortment of catheters of different dimensions, that he may be prepared for any emergencies that may arise. For washing out the bladder, for the removal of blood and mucus, or for introducing fluids, a double catheter is necessary (fig. 423). When the object is to throw up medicated fluids, such as nitric acid and water, a silver instrument is required.

When the urethra is entirely sound, a tolerably large catheter, one that will distend the parietes of the tube, is selected. An instrument of this size is not so likely to be arrested by the folds and follicles of the mucous membrane, or to impinge against the margins of the opening in the triangular ligament. Immediately previously to inserting it, it should be well warmed and oiled.

The catheter may be introduced while the patient is standing, sitting, or lying; but, whatever posture may be selected, it is important that the thighs should be moderately separated from each other, and flexed upon the pelvis, to relax the abdominal muscles. In the first case, the patient leans with his back against the wall, and inclines his chest slightly forwards, so that he may not change his position during the operation. The surgeon may take his place either at the front or side. If he sit, the breech should project over the chair, and the body be directed backwards. The position of the operator is the same as before. The most convenient posture, however, is the recumbent. The patient lies on his back, near the edge of the bed, the head being supported by a pillow, and the knees, slightly separated from each other, somewhat raised. The surgeon, standing at the left side of the bed, takes the penis in the left hand, and raises it to a right angle with the body to efface the curve which it forms at the pubes. The catheter, held in the right hand, between the thumb and first two fingers, is inserted into the orifice of the urethra, its concavity being directed towards the pubes, while the handle is nearly in contact with the median line of the abdomen. The instrument is now passed on, until its beak reaches the sinus of the bulb, which lies upon the anterior surface of the triangular ligament, rather deep in the perineum. To disengage it from this depression, the handle is changed from the horizontal direction, in which it has hitherto been held, into the vertical, at the same time that the point is slightly retracted. By this manœuvre, the curved portion is brought under the arch of the pubes, and immediately opposite the opening in the triangular ligament. By now depressing the handle of the instrument on a level with the thighs, or, rather, a little between them, its point glides readily over the prostatic part of the urethra into the bladder.

In performing this operation, no force is employed; on the contrary, the whole proceeding is conducted with the utmost gentleness. The



catheter, held as lightly as possible, is made to glide along, as it were, by its own weight, and by that of the hand. The penis should be drawn slightly forward over the instrument, just sufficiently to render the urethra a little tense. Everything like stretching and pulling should be avoided.

In introducing the straight catheter, the patient lies on his back, and the surgeon stands on the right side of the bed, instead of on the left, as in the other case. The penis is held in the left hand, at a right angle with the body, and the instrument is carried down perpendicularly as far as the sinus of the bulb. To free it from this depression, the point is retracted a few lines, and then, while the penis is lowered between the thighs, it is at once pushed onward into the bladder.

Various contrivances are used for retaining the catheter in the bladder. The one which I usually prefer consists of a broad waist-band, with two thigh-pieces fastened in front and behind, so as not to interfere with the anus and the scrotum. The instrument having been introduced, is secured by two strips of linen, tape, or oiled silk, by tying the middle of each to the ring of the catheter, and the ends to the vertical bands. Another very good plan is to surround the penis with an ivory, elastic, or linen yoke, and to secure this against the pubes by means of four pieces of tape, carried round the thighs and pelvis. The catheter is then fastened to the ring or yoke in the usual manner. In the annexed drawing (fig. 424), the instrument is secured to a piece of linen, passed round the penis, just behind its head. The contrivance, however, is objectionable, on account of its liability to injure the penis, in case of erection.

Fig. 424.



To prevent undue pressure upon the mucous membrane of the bladder, the catheter, if intended to be retained, should be at least from one to two inches shorter than one used for merely drawing off the urine.

#### PUNCTURE OF THE BLADDER.

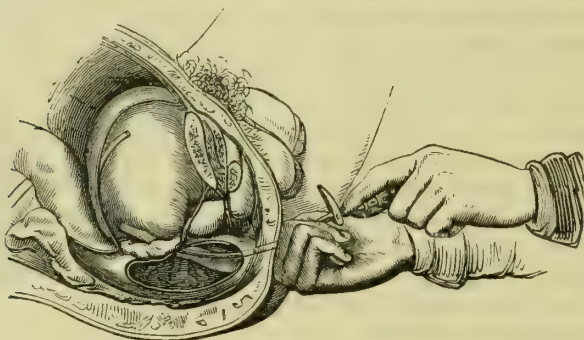
When the bougie, catheter, and other means have failed to procure relief, the only thing that remains is to puncture the bladder. Fortunately, this operation is seldom necessary. It is only in cases of excessive enlargement of the prostate gland, attended with great tenderness and swelling of the surrounding parts, in laceration of the urethra, infiltration of urine into the scrotum, and in deep-seated, impassable stricture, that the operation should ever be seriously thought of. I have myself been obliged to perform it only once, and then the case was not my own.

There are four routes by which the organ may be approached when this operation becomes necessary, namely, the rectum, the perineum, the hypogastrium, and the pubic symphysis. Of these, the first

is the one usually preferred, on account of the facility of performing the operation, and its supposed freedom from the danger of urinary infiltration. It is, of course, contra-indicated when there is great enlargement of the prostate gland, or serious disease of the anus, the rectum, or bas-fond of the bladder.

a. The *rectal* puncture is executed with a curved trocar, about four inches in length, and provided with a suitable canula. The breech of the patient is brought over the edge of the bed, and his legs are supported by two assistants, as in the operation for stone. The surgeon, oiling the index and middle fingers of the left hand, introduces them into the bowel, in contact with its anterior wall; he then takes the instrument in the right hand, and retracting the point of the trocar within its sheath, places it in the groove formed by the junction of the two fingers. When the instrument has passed the posterior margin of the prostate gland, the handle is depressed, and the point urged on through the superimposed structures into the interior of the bladder (fig. 425). The want of resistance, and a slight escape of

Fig. 425.



urine, will indicate that the instrument has reached its destination. By a sort of double movement, the trocar is now withdrawn, and the canula pushed farther on into the distended viscus. The urine being evacuated, the canula is either at once removed, or, if there be any serious obstacle along the natural passage, it is retained until this is surmounted.

b. The *perineal* puncture is to be preferred, when the retention is caused by an impassable stricture, or by injury of the urethra, the perineum, or the neck of the bladder, followed by infiltration of urine. The patient being placed and held, as in the other operation, a moderate sized catheter is carried down to the seat of the obstruction, where it is firmly supported by an assistant, and its point exposed by direct incision, in the raphé of the perineum. The knife is next conveyed backwards, through the constricted part, and thence by successive touches on through the posterior portion of the urethra as far as the neck of the bladder. As soon as the organ is reached, the urine rushes out in a full stream. A catheter is then passed and retained

in the usual manner. Care is taken not to wound the rectum and the arteries of the bulb.

c. The *supra-pubic* puncture of the bladder has generally been regarded as more objectionable than any other, because of the great danger of the escape of urine into the peritoneal cavity, and the surrounding cellular substance. In performing the operation, the patient is placed on his back, the skin is divested of hair, and an incision is made from below upwards, along the median line, from an inch to an inch and a half in length, according to the condition of the part, first through the common integuments, and then through the fibrous structure between the pyramidal muscles, down to the cellular tissue which covers the distended organ. Through this opening the bladder is pierced at its lowest part, by means of a long curved trocar (fig. 426), the point of the instrument being inclined obliquely downwards, and backwards in the direction of the promontory of the sacrum. Transfixion being completed, the trocar is withdrawn, and the canula gently passed into the bladder, where it is retained by an appropriate bandage, until the obstruction necessitating the operation has been removed. The patient, in the mean time, lies on his side, to promote the escape of the urine.

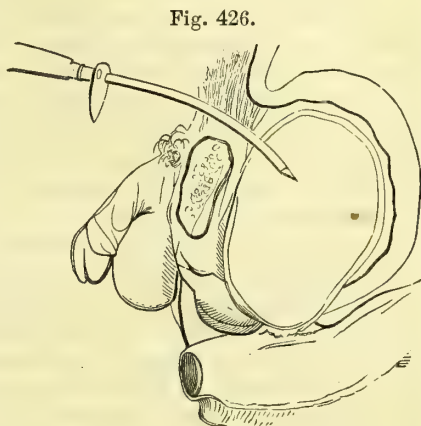


Fig. 426.

d. The *inter-pubic* puncture of the bladder is of modern invention; and, although it has been performed successfully by several surgeons, among others, by Dr. Leasure, of Pennsylvania, it would, perhaps, be premature to express any opinion respecting its relative and absolute merits. As the name implies, the instrument is passed through the centre of the pubic symphysis, and, consequently, only a short distance from the urethra. It has the advantage of facility of evacuation, and of freedom from infiltration.

#### INCONTINENCE OF URINE.

Incontinence of urine, the reverse of retention, with which it is often associated, may occur at any period of life, and may be partial or complete, temporary or permanent. It may be excited by a great variety of circumstances, the most prominent of which, however, are referable to external injury, or to inflammation, spasm, paralysis, or morbid sensibility of the bladder, or of this organ, and of the urethra. The water may pass off as fast as it is secreted, or it may be retained for a time, and then either dribble away, or be discharged in a full stream.

a. The best example of incontinence from *external injury* is afforded



in lithotomy. A kick, blow or fall upon the perineum is occasionally followed by a similar result. Incontinence from this cause often disappears spontaneously; and, on the other hand, it is occasionally incurable. The treatment must be conducted upon general principles.

*b. Incontinence from inflammation* may depend upon various circumstances. The escape is usually partial, and is almost constantly associated with severe pain and spasm. The treatment consists in removing the exciting cause, and in employing the lancet, the hip bath, anti-spasmodics, and anodyne injections. The catheter often affords instant relief.

*c. Paralysis of the bladder*, or of this viscus and of the urethra, however induced, is a frequent cause of incontinence. It is particularly liable to supervene upon injury of the brain and spinal cord. It also occasionally follows parturition. Owing to the fact that the sphincter muscle generally retains some contractile power, more or less of the urine is apt to accumulate in the bladder, while the rest gradually passes off, leading thus to a belief on the part of the practitioner that the case is one purely of incontinence, when, in fact, it is one both of incontinence and retention.

In the treatment of this affection, our remedies must be addressed chiefly to the invigoration of the nervous system. For this purpose, after having cleared out the bowels and corrected the secretions, the patient is put on the use of strychnia, either alone or combined with some mild tonic, such as the extract of gentian and sulphate of iron. Cantharides may also be advantageously given, especially if they be carried to the extent of slight strangury. The diet should be light, and the patient should make frequent use of the cold shower bath, followed by dry frictions. Counter-irritation by blisters is kept up in the sacro-lumbar region.

Incontinence may arise from a *morbid sensibility* of the neck of the bladder, or of the entire organ, excited by the acid character of the urine, or by sympathy with the kidney, rectum, anus, vagina, or uterus. Masturbation, or inordinate sexual indulgence, may be followed by the same result. In most of these instances, the incontinence is incomplete.

To this form of incontinence obviously belongs that variety of the disease which occurs in young subjects, especially in *boys*. It is most common before the age of ten, and often begins very early in life. The discharge, which may take place several times during the night, is occasionally effected under the influence of the will or of a dream, but, in general, it is strictly involuntary. When it becomes habitual, as it usually does, it may last for years. In most cases, however, it gradually disappears on the approach of adolescence. It is promoted by the use of fluids, by exposure to cold, and by sleeping on the back, a posture which is favorable to the accumulation of urine in the morbidly sensitive portion of the bladder.

In the *treatment* of this form of incontinence, particular inquiry should be made into the nature of the exciting cause, the removal of which is of paramount importance. In that variety of the affection which is met with in boys and girls, the cure may be greatly expedited

by proper attention to the diet, which should always be bland and unirritating. Late suppers are avoided, and the patient must abstain entirely from drinks for several hours before going to bed. During the night, he is to be waked two or three times for the purpose of emptying his bladder, and this practice is to be persisted in for weeks and even months, until the disagreeable habit is broken up. During all this time, as well as, indeed, for a long period afterwards, the child should lie upon his side, to prevent the urine from coming in contact with, and irritating the neck of the bladder. The internal remedies, from which I have derived most benefit in the treatment of this affection, are strychnine and cantharides, given three times a day, in the proportion of the twentieth or thirtieth of a grain of the former, to the twentieth of a grain of the latter, according to the age of the subject. A minute portion of morphia forms a valuable addition; and, in atonic cases, I often combine with these articles some of the preparations of iron. When the strychnine disagrees, or fails to answer the purpose, we may substitute the extract of *nux vomica*. In either case, it is important to watch the effects of the remedy. I have great confidence in the use of cantharides in this affection, having known them to afford relief when everything else seemed to prove unavailing. I prefer the powder to the tincture, and occasionally continue the exhibition of it until slight strangury is induced. Benzoic acid has also been highly recommended, but the trials I have made of it have disappointed my expectations. When the morbid sensibility of the bladder is connected with inflammation, the balsam of copaiba, in doses of from ten to fifteen drops every eight hours, is sometimes beneficial. In this variety of the affection a full anodyne at night, especially in the form of Dover's powder, often exerts a happy effect in controlling the discharge.

The cold shower-bath should be used twice a day, or cold water poured from a considerable height upon the lower portion of the spine, and blisters applied to the sacro-lumbar region, the perineum, and thighs. In obstinate cases, the neck of the bladder is cauterized, as in spermatorrhœa, but much more mildly. In the female the application is made to the orifice of the urethra.

Belladonna has been recommended in the treatment of this variety of incontinence of urine by Dr. Trousseau and Dr. Blanche, of Paris. A steady persistence in the treatment for several months is necessary to insure a cure.

The application of pressure to the urethra, gentle, but steady, and gradually increased, has sometimes been found beneficial in removing the complaint.

In all cases of nocturnal incontinence, the practitioner must endeavor to secure the co-operation of the patient. The child must be reasoned with, and even threatened with chastisement; of course, he is not beaten, nor does any sensible man ever think, at the present day, of tying up the penis.

Some very interesting facts in relation to nocturnal incontinence of urine, have recently been published by Dr. Addinell Hewson. In the House of Refuge, of Philadelphia, of which he is surgeon, the disease

prevailed as an endemic in 1857, not less than 78 out of 292 boys, the whole number of inmates, being affected simultaneously. Of the 78, only 63, however, were under observation all the while, and of these, 34 were negroes. The ages ranged from seven to eighteen years, the average being thirteen. Many of the boys bore the marks of ill health, especially of disorder of the digestive organs. Twenty-four suffered from ascarides; some had herpes; twenty labored under constipation; and nearly all were suspected of masturbation, eighteen acknowledging their guilt. The prepuce was discolored and elongated, either from frequent scratching or pulling, in not less than 46 cases. A considerable number wet themselves both day and night. The urine deposited uric acid in nearly one-half of the cases. The use of stimulating food, and sudden atmospheric changes, always produced a marked increase of the disorder. The remedies which proved most efficacious were the juice of belladonna, prepared according to Bentley's process, magnesia, the cold douche, and a reduced supper of bread, without any drink. Those who had worms were treated with turpentine and bicarbonate of soda. Each boy was compelled to get up and micturate an hour after retiring at night. Under this treatment, especially the influence of a restricted diet, enjoined as a punishment, the endemic rapidly disappeared.

Finally, when the incontinence is irremediable, the patient should wear a urinal, to prevent the fluid from soiling his clothes. The best contrivance for this purpose is a gum-elastic bottle, shaped somewhat like a Florence flask, and capable of holding about twelve ounces. The subjoined cuts will convey a better idea of the apparatus than any description. Fig. 427 represents the male, and fig. 428 the female

Fig. 427.

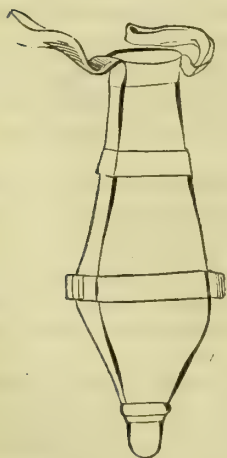


Fig. 428.



urinal. Each instrument is furnished at its inferior extremity with a screw, for the purpose of evacuating the urine after it has accumulated to some extent in the artificial reservoir. The interior should be



frequently washed for the sake of cleanliness, and every patient should be provided with an extra vessel, so that he may not suffer any inconvenience in case of accident.

#### HEMORRHAGE OF THE BLADDER.

A discharge of blood from the bladder, technically denominated hematuria, although not of frequent occurrence, is generally a source of disquietude to the patient, from a belief, not altogether unfounded, that it is a symptom of evil import. The bleeding occurs in both sexes, and at all periods of life. Men, however, are more prone to it than women; and it is likewise more common in old and middle-aged subjects than in children and adolescents.

Vesical hemorrhage presents itself under two varieties of form, the idiopathic and the traumatic. The idiopathic variety is infrequent, and is met with chiefly in elderly persons of a weak, lax habit of body, or in such as are affected with scurvy or an anemic condition of system. It sometimes occurs in association with, or in consequence of, rubeola, smallpox, plague, and typhoid fever. The traumatic form is usually the result of a wound of the bladder, or of the rude and forcible use of instruments.

Persons affected with stone are very liable to suffer from hemorrhage of the bladder, especially after any rough exercise. Worms in the bladder have been known to cause profuse and even fatal hemorrhage of this organ. Violent concussion of the body, severe exercise on horseback, and venereal excesses, may be enumerated as among the more common causes of the affection.

A considerable hemorrhage of the bladder occasionally results from the use of drastic cathartics and irritating diuretics. Ulceration of the mucous and submucous cellular tissue of the organ is nearly always accompanied by bleeding, and one of the most characteristic signs of fungous, encephaloid, and erectile tumors, is a considerable flow of blood. Finally, vesical hemorrhage is sometimes vicarious of the menstrual flux, and of suppressed hemorrhoidal discharges. It also, though rarely, marks the crisis of other diseases.

When recently effused into the empty bladder, the blood is of a natural appearance; but if it has been retained for some time, or been mixed with the urine, it assumes a dark-brownish, turbid, or muddy hue. In its consistence, the blood may be liquid, semi-fluid, or completely solid.

The *symptoms* of vesical hemorrhage are a discharge of blood from the urethra, either alone or in combination with the urine, and accompanied, if the quantity be at all considerable, by a frequent desire to micturate, spasm at the neck of the bladder, and a burning sensation along the course of the urethra. When the blood coagulates nearly as fast as it is poured out by the bladder, it may lead to retention of urine. Copious effusions of this kind may be followed, sooner or later, by all the symptoms of exhaustion.

As hemorrhage of the bladder is liable to be mistaken for hemor-

rhage of the kidneys, the ureters, prostate gland, and urethra, the *diagnosis* is sometimes extremely difficult, if not impracticable. In case of direct injury of the bladder, there need be no doubt. In the idiopathic form of the hemorrhage, however, great uncertainty must frequently exist. Under such circumstances, the history of the case, and the absence of disease, or injury of the associated organs, may assist in clearing up the difficulty, and leading to a correct diagnosis. In renal hemorrhage, the disruption is usually dependent upon injury or organic disease of the kidneys, and is, therefore, apt to be preceded and accompanied by symptoms referable to these organs. The blood is commonly of a pale, pink, or claret complexion, and either entirely fluid, or partly fluid and partly coagulated; it is never voided in a pure state, as it often is when it proceeds from the urethra, or the neck of the bladder. The microscope also discovers what are called blood casts, consisting of blood moulded in the uriniferous tubes, and washed out by the urine. When the bleeding proceeds from the ureters, it is generally produced by the presence of a calculus, which gives rise to the symptoms associated with the passage of concretions along those conduits.

Hemorrhage of the urethra is generally produced by external violence, the passage of a calculus, or the venereal orgasm, and the blood commonly passes off in small vermiform pieces, without any material change of color, or any desire to void the urine. In many cases, the blood is discharged in drops, or in a small stream.

In the traumatic variety of hemorrhage, the ordinary hemostatics are, of course, indicated, and should be employed without delay. Accessible arteries are exposed and tied, or, when this is impracticable, compression and cold applications are used. All offending causes are sought for, and, if possible, removed. When the bleeding proceeds from an encephaloid, fungous, or erectile tumor, palliation alone is attempted. In such cases our main reliance is upon opium and lead, gallic acid, alum, and perchloride of iron, with acidulated drinks, rest in the recumbent position, and cold applications to the perineum and hypogastrium. The catheter should be avoided.

In cases of vesical hemorrhage, dependent upon fungous excrescences of the bladder, I have generally succeeded in affording prompt relief by a good dose of calomel and rhubarb, followed by alum and opium, with sulphuric acid and infusion of roses as a common drink.

In idiopathic hemorrhage of the bladder, great attention must be paid to the system. Vascular action is reduced, the bowels and secretions are carefully regulated, the diet must be light and unstimulating, and the drinks should be cooling and acidulated. Absolute rest in the recumbent posture is of primary importance. The most useful remedies are gallic acid, acetate of lead, and sulphate of alum. These articles ought usually to be combined with opium. Tannic acid, and elixir of vitriol, also prove highly efficacious. If anemia be the cause of the hemorrhage, chalybeate tonics are indicated, and the best forms are the tincture of the chloride, the sulphate, and the aromatic wine of iron. In bleeding of the bladder, vicarious of the menstrual flux,

emmenagogues, and aloetic purgatives are required. In all cases, the action of internal remedies is promoted by refrigerant applications to the perineum, the inside of the thighs, and the hypogastric region. Cold enemata are also beneficial, and a lump of ice introduced into the rectum sometimes acts like a charm. Leeches, or cupping over the sacrum, may be useful, when there are pain and spasm. Direct medication, by astringent injections, occasionally proves serviceable. If the blood coagulate so as to distend the bladder, it may sometimes be removed by injections with cold water, or, what is still better, vinegar and water, after the clot has been broken up by a silver catheter.

When all other means fail, and the symptoms are so urgent as not to admit of further delay, the only thing to be done is to open the bladder, as in the operation of lithotomy. When practicable, the lateral method should be performed, and the clotted blood be removed with the scoop.

#### POLYPOUS, FUNGIOUS, ERECTILE, AND OTHER MORBID GROWTHS.

The bladder is liable to *polyps*, occurring chiefly in young subjects; sometimes, indeed, within less than two years after birth. An instructive paper, detailing the particulars of ten cases, including one by himself, has recently been published by Mr. Birkett, of London. The growth described by this distinguished surgeon was attached to the upper boundary of the neck of the bladder, from which it projected forwards into the urinary meatus; the patient being a girl five years of age. It was composed of lobes and lobules, and was of a soft, friable consistence, not unlike certain nasal polyps. It was covered with epithelium, but was not very vascular.

Various anomalous growths, known by the terms *fatty* and *steatomatous*, are sometimes observed in the bladder, but their occurrence is so rare that it is scarcely necessary to allude to, much less to describe them. They seldom attain a large bulk, are generally situated in the bas-fond of the organ, and always exhibit the same structure as in other parts of the body.

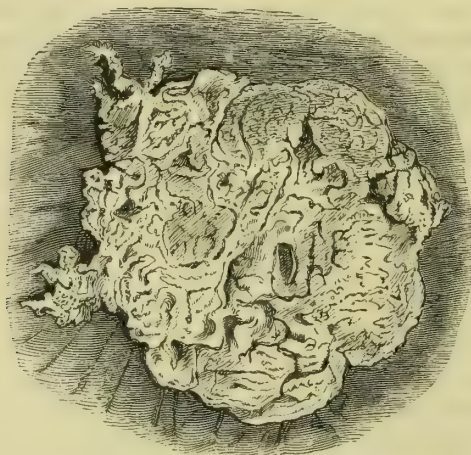
A peculiar *fungous growth*, a species of vegetation of the mucous membrane of the bladder, is also occasionally met with. Varying in its size from that of a pea to that of a pullet's egg, it is of a soft, spongy consistence, with a rough, fimbriated, or villous surface. It consists of a grayish, cellulo-fibrous tissue, covered by a prolongation of the lining membrane. Small vessels enter it in different directions, and are liable, when ruptured, to pour out a considerable quantity of blood. The only evidence of the existence of this disease is the presence in the urine of a portion of the abnormal substance.

Finally, tumors of an *erectile*, vascular character, similar to that of an anastomotic aneurism, or a maternal nevus, sometimes occur in this organ. The annexed drawing (fig. 429), taken from a preparation in the pathological collection of the New York Hospital, represents a growth of this description. The specimen was deposited by Dr. Cheeseman, to whom I am indebted for the following history of the case. The



patient was a widow, seventy-two years of age, of a spare habit of body, and the mother of five or six children. Though naturally feeble, her general health was always good until about three years before her death, when she began to complain of uneasiness in her bladder,

Fig. 429.



attended with a frequent inclination to void her urine, which was always mixed with blood. Her symptoms gradually increased in violence; she became pale and anemic, and finally died completely exhausted. For some time before her death, she suffered severely from pain in the bladder during micturition, especially immediately after the passage of the last drops of water. She never experienced any retention, and the blood always came away in a dissolved condition. Upon dissection, a tumor was found upon the floor of the bladder, of a soft, spongy character, of a florid color, circular in its form, and about two inches in diameter. It seemed to spring from the mucous membrane, and had a rough, irregular surface, not unlike that of a cauliflower. The parts around were free from inflammation and other disease; but the muscular tunic was somewhat thickened and reticulated. All the other organs were healthy.

Of the exciting *causes* and diagnostic characters of polypous, fungous, steatomatous, and other tumors of the bladder, nothing, unfortunately, is known. From the constant pains in the pelvic region, with the straining efforts, and the frequent inclination to void the urine, which are almost always present, the existence of stone is apt to be suspected; an apprehension which is not always relieved by sounding, which, however, should never be omitted in cases of a doubtful nature. Whenever their real character can be ascertained, the bladder should be laid open as in the common operation of cystotomy, and their removal effected with a pair of probe-pointed scissors curved on the flat.

No internal remedies exert the slightest influence in arresting these tumors, or in modifying their development. Hence, all that the prac-

tioner can do, when the disease cannot be reached by operation, is to endeavor to palliate the patient's suffering by anodynes, and such other means as his actual condition may, from time to time, seem to require.

#### HETEROLOGOUS FORMATIONS.

The bladder is liable to malignant diseases, as scirrhus and encephaloid, or hard and soft cancer. Of colloid and melanosis, as occurring in this organ, hardly any cases have been published. I have myself seen only one example of the latter, the patient being a man, fifty-eight years of age. The disease, which presented itself in the form of five or six little nodules, co-existed with melanosis in nearly all the principal organs of the body.

*Scirrhus*.—Scirrhus of the bladder, properly so called, is extremely uncommon. I have only met with one well-marked case of it. It has hitherto been chiefly observed in men, between the ages of forty-five and sixty, at the neck and bas-fond of the organ. It occasionally co-exists with scirrhus in other organs, as the liver, uterus, breast, and prostate gland. During the progress of this disease, the associated organs are apt to become implicated.

There are no *signs* by which scirrhus can be distinguished from other diseases of the bladder. The most reliable evidences are, the peculiar, lancinating character of the pain, the progressive emaciation, the wan and sallow state of the countenance, the age of the patient, the excessive burning at the neck of the organ, and in the urethra immediately after micturition, and the occasional discharge of small fragments of the heterologous matter. Negative testimony is afforded by sounding. No positive conclusion can be drawn from the frequent micturition, the condition of the urine, and the presence of mucus, pus, or puriform fluid.

The suffering in this disease is generally so excessive as to require enormous doses of morphia, both by the mouth and rectum, for its relief. In the only case of the kind that I have ever seen, the pain was more severe than I have ever witnessed in any other disease. Towards the close of the disease, anodynes produced so little effect that the poor patient, a gentleman, forty-four years of age, was obliged to be kept almost constantly under the influence of chloroform. The dissection showed an ulcerated scirrhus of the bas-fond of the bladder.

*Encephaloid*.—Encephaloid of the bladder, likewise known by the name of fungous hematodes, soft cancer, or medullary sarcoma, usually runs its course with great rapidity, destroying life in from nine to twelve months. Any portion of the organ may be affected with it, but its most common situation is just behind the neck, between the mouth of the urethra and the outlets of the ureters. It may occur as a solitary tumor, projecting into, and almost filling up, the bladder, or in the form of small nodules, from the volume of a pea up to that of a walnut. The starting-point of the disease is always the submucous cellular tissue.

Tumors of this kind are often associated with calculi, which are

either partially embedded in their substance, or else they lie loose in the bladder. When of large size, they encroach so much upon the organ as to leave hardly any room for the urine. In most cases of encephaloid, the intermediate substance of the bladder is perfectly healthy; in others, it is diseased and hypertrophied. Sometimes the organ is very much contracted, while occasionally, though rarely, it is greatly enlarged.

The *symptoms* which are most characteristic of the existence of this disease are, uneasiness about the neck of the bladder, frequent micturition, a bloody state of the urine, a discharge of cerebriform matter, and a peculiar cachectic state of the countenance. When all these phenomena are present, no reasonable doubt can be entertained respecting the nature of the case. Still, as error is liable to arise, the practitioner should never rest satisfied until the bladder has been thoroughly explored by the sound. Should no calculus be detected, it will afford additional proof of the existence of encephaloid. The operation, it may also be stated, is generally attended, in the latter case, with considerable hemorrhage. The tumor can often be perceived by the finger in the rectum. A microscopic examination of the suspected matter often affords useful information.

Mitigation of suffering is all that can be aimed at in this disease. The proper remedies, of course, are anodynes, in full and sustained doses. To check the hemorrhage which always attends the ulcerative stage, it will be necessary to make free use of perchloride of iron and opium, acetate of lead, alum, tannin, creasote, and similar articles. When the discharge is obstinate, or unusually copious, astringents may be thrown into the bladder.

#### TUBERCULAR DISEASE.

The bladder is sometimes the seat of tubercular disease. The deposit is commonly met with in the form of minute granulations, similar to those which occur in the bowels and lungs. Their number is generally small. It is probable that they may occur in any part of the bladder, but they are by far most common in the neck and bas-fond of the organ.

The *seat* of this deposit is in the mucous follicles, in the substance of the mucous membrane, and in the submucous cellular tissue. After it has existed for an indefinite period, it begins to soften, and is finally entirely broken down and expelled, leaving each, in its stead, a small, roundish ulcer, with thin, ragged, and undermined edges.

Tubercular disease of the bladder is generally, if not invariably, associated with the same deposit in other parts of the body, especially the kidney and the prostate gland. Its co-existence with tubercular disease of the lungs is uncommon.

There are, unfortunately, no *symptoms* by which we can, with any certainty, determine the existence of tubercular disease of the bladder. As long as the deposit remains in a state of crudity, there is, in general, merely a slight degree of irritability of the mucous membrane, with increased frequency of micturition. When the softening process has



commenced, the peculiar matter of tubercle is discharged along with the urine, in which it can often be detected by the naked eye. Where any doubt exists, a small quantity should be placed under the microscope.

The ulceration attending this disease occasionally spreads over the whole mucous surface, which is removed in as clean and perfect a manner as if it had been dissected off with the knife. Several specimens, illustrative of this condition, are contained in my private collection. When the case has reached this point, the suffering is most excruciating, there being a constant desire to pass water, and the patient being rapidly worn out by the conjoint influence of pain and want of appetite and sleep. Palliation by anodynes, in full and sustained doses, is all that the disease admits of.

#### HERNIA OF THE BLADDER.

The bladder, like the other abdominal viscera, is liable to protrude from the pelvic cavity, constituting what is denominated cystocele. A hernia of this description is sometimes complicated with a bubonocoele, or rupture of the groin, which it may either precede or follow. Occasionally stone co-exists in the protruded organ.

The cystic hernia is destitute of a proper sac. The only exception to this rule is where the rupture is of long standing, or of great bulk, in which case the fundus of the bladder may drag the peritoneum down into the scrotum. The swelling is always formed, in great measure, by the superior portion of the viscus, and is generally of small size, though occasionally it has been known to attain the magnitude of a fist.

A cystocele is a soft, elastic, and fluctuating tumor, which varies in its size according to the amount of urine contained in the protruded part. When examined in a dark room, with the aid of a candle, it appears translucent, very much like a hydrocele.

The *diagnosis* of cystocele is a matter of importance, as a tumor of this kind has occasionally been cut into by mistake. The most decisive symptom is the change which the swelling undergoes in its volume during micturition. As the water flows off the tumor decreases, or entirely disappears, to recur again, however, as soon as the urine has re-accumulated, to some extent, in the protruded part. A cystocele has not the doughy, inelastic feel of an omental hernia, nor the soft, gaseous feel of an intestinal one, nor does it return with that peculiar gurgling noise which accompanies the ascent of the latter.

The *treatment* of cystocele, seated in the groin or scrotum, does not differ from that of intestinal hernia. When the tumor is reducible, it should be kept up by means of an appropriate truss; but when the viscus has contracted adhesions, and no longer admits of reposition, the patient must be contented with a suspensory bag. The urine which accumulates in the lower part of the sac must be discharged by raising and compressing the tumor during micturition. If retention should take place, and relief cannot be afforded by the catheter, the part should be punctured. If calculi collect, and become a source of great suffering, they may be extracted by incision of the sac.

## URINARY DEPOSITS.

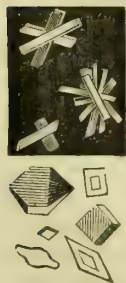
The only deposit in perfectly normal urine is a slight amount of mucus and epithelial debris, which gradually subside as a delicate cloud as the fluid cools; but in various abnormal conditions of this excretion, either from excess of its constituents, from a hyperacid condition, or, again, from an alkaline state, owing either to the fixed or volatile alkalies, we find other precipitates. The most common of these are, first, uric acid, either pure or combined with some bases; second, phosphatic acid, as the phosphate of lime, the phosphate of magnesia, or what is called the triple phosphate, consisting of a combination of phosphoric acid with magnesia and ammonia; third, oxalic acid, in combination with lime; fourth, cystine and xanthine. The two latter substances, however, are very infrequent.

1. *Uric acid* appears as a deposit in crystals, under varied forms, some of which are a modification of the rhomboids. The urates present themselves as an amorphous sediment, of which there are two, the yellow and the red. The color is owing, in the former, to hematine, the mal coloring matter of the urine; and, in the latter, to a peculiar pigment, termed purpurine.

Both uric acid and the urates are distinguished from all other deposits by their behavior with nitric acid, on the addition of a drop of the concentrated fluid to a small quantity of the secretion. The first perceptible effect is an effervescence, followed by solution; and on drying the mass carefully over a spirit lamp, a beautiful crimson tint is produced, termed murexid. The color is much heightened by subjecting the residue to the fumes of ammonia. The two deposits are also readily distinguished from each other.

The *crystallized sediments*, red sand, or gravel, consist of lithic acid, nearly in a pure state. They appear in the form of minute particles, resembling very much, in shape, size, and color, the particles of Cayenne pepper. Heat does not dissolve them,

Fig. 430.



as it does lithate of ammonia. Under the microscope, they are found to consist of exceedingly delicate crystals, most of which have the appearance of rhombic prisms, which may, therefore, be assumed as their normal form. The most perfect specimens are generally contained in the deposits of yellow sand in the urine of young infants. The crystals are sometimes nearly square; or they are very thin, and longer than broad, so as to represent square tables; or, finally, they are so thin as to appear merely like pale, lozenge-shaped lamellæ. Occasionally they lie across each other, and are firmly coherent.

The urates appear as a colored, amorphous deposit, and are redissolved on heating the urine, which is not the case with uric acid. An excess of the yellow deposit may generally be regarded as denotive of disturbance of the digestive functions, or disorder of the cutaneous transpiration. The urine depositing this substance is of a pale amber

tint, more or less acid, and clear when voided. Its quantity is commonly confined within the natural limits, its specific gravity ranging from 1.015 to 1.025.

The red deposits are always present in those states of the system which are attended with imperfect assimilation, or a want of proper aeration of the blood. The pink sediment described by Prout, is merely a variety of this; it is exceedingly rare, and is generally expressive of organic disease of the lungs, liver, or spleen.

The crystallized sediments are generally produced under the influence of a luxurious, indolent life, attended with dyspepsia, flatulence, acidity, and constipation of the bowels, with disorder of the cutaneous secretion.

In the *treatment* of this affection, it is important to ascertain, if possible, the causes by which it has been induced. It may be assumed, from what has been stated previously, that these deposits are all dependent upon the retention in the system of nitrogenous principles, which, in consequence of derangement of the cutaneous and other emunctories, are obliged to pass off by the kidneys. The causes which may conduce to this result are—1st. Imperfect assimilative action. 2d. The use of unwholesome food and drink. 3d. Defective oxygenation of the blood from disorder of the lungs and skin; and, 4th, congestion, irritation, or inflammation of the urinary apparatus.

The first indication, is to improve and invigorate the state of the digestive organs; 1st, by attention to the patient's diet, and, 2dly, by a proper regulation of his bowels. As a general rule, no articles of food should be permitted that are known to disagree. All kinds of pastry, fresh bread, and oily, fatty, and saccharine substances, should be interdicted. Boiled fish, raw oysters, and the white meats, may be used in moderation once a day. For breakfast and supper, the latter of which should always be very light, brown bread, dry toast, and soda biscuit, with a small quantity of butter, and a cup of black tea, will generally be sufficient. At dinner, green vegetables and ripe fruits may be indulged in, provided they do not impede the digestive process, or create flatulence and acidity. They promote the peristaltic action of the bowels, and furnish the urine with alkaline matter, thus preventing the deposit of gravel, or lithic acid. Beef, pork, and mutton, if used at all, should be taken very sparingly. An important rule is to masticate as thoroughly as possible, to eat slowly, and not to overload the stomach, or overtask the powers of this organ. Coffee, beer, and alcohol, should be avoided. If the patient has been accustomed to the use of wine, he should either be obliged to discontinue it entirely, or limit himself to a little dry sherry or Madeira at dinner, though brandy and gin are far preferable. Hard water must be avoided. Some mild aperient occasionally should be given to regulate the bowels, such as blue mass and rhubarb. Active purgation is rarely required, or proper, while there is much acid in the stomach and bowels. Castile soap may be advantageously united with the cathartic medicines.

Exercise should be taken at stated periods, in the open air, on foot, on horseback, or in a carriage. A valuable rule is never to carry the exercise to fatigue, or to take it immediately after a meal.



It is a matter of primary importance to maintain the skin habitually clean and pure. In warm weather, spongings with cold water, either simple, or impregnated with salt, mustard, or red pepper, followed by frictions, should be used, and provided there is no contra-indication, the same plan may be pursued in winter. Cold ablutions are more invigorating than warm. They are, in fact, to the external surface what cold air is to the lungs. Nevertheless, a warm bath is occasionally highly beneficial, especially during a fit of the gravel.

The body and bedclothes should be frequently changed and aired, the skin should be protected both summer and winter with flannel, and the patient should avoid exposure to cold.

When the lithic deposit is connected with a gouty or rheumatic diathesis, recourse must be had to colchicum, preceded and accompanied by mercurial cathartics. Not unfrequently it is necessary to administer mercury in alterative doses until slight ptyalism is produced.

When tonics are required, the best articles are quinine, iron, and the mineral acids, particularly the nitric and nitromuriatic. The vegetable acids are also beneficial. Both kinds may be exhibited, either alone or in combination, with some of the vegetable bitters.

The bicarbonate of soda and of potassa, either alone or together, may be given to relieve acidity. The best time of exhibition is about an hour after meals. Phosphate of soda, liquor potassæ, and benzoic acid, are also valuable remedies.

Irritation of the urinary organs, especially if inflammatory, may be relieved by the application of leeches, cups, and blisters to the lumbar region, sacrum, or perineum. The warm bath will also be useful, and anodyne injections rarely fail to afford prompt relief.

Opiates have a happy effect in controlling the excretions in question, often curing the milder, and mitigating the distress in the more severe forms. Morphia, lupulin, and hyoscyamus, are the best of this class. When the skin is disordered Dover's powder may be administered.

2. The *oxalic deposit* holds, in point of frequency, an intermediate rank between the lithic and phosphatic. It occurs in the form of a white, glistening powder, which is suspended in the urine, and manifests no disposition to precipitate itself, unless it can attach itself to some substance capable of constituting a nucleus. Examined with

Fig. 431.



the microscope, this powder is found to consist of beautiful, transparent crystals, of an octohedral figure, with sharp and well-defined edges and angles. Occasionally, though rarely, they are shaped like dumb-bells, or like two kidneys united at their concavities, and so closely approximated as to appear almost circular (fig. 431). They vary much in their size, but, in general, they are exceedingly minute. If they are subjected to ignition on platinum foil, the oxalic acid is decomposed, and a small quantity of carbonate of lime is left, which is readily dissolved with effervescence on the addition of dilute nitric acid. Oxalic acid sometimes occurs as a

distinct deposit, in the form of a small concretion resembling a hemp-seed, which may be retained in the bladder, and go on gradually increasing until it constitutes a mulberry calculus.

The formation of oxalic acid is favored by whatever has a tendency to impair the assimilative powers and to exhaust the vital energies. Hence, it is most commonly induced by errors of diet, or the use of unwholesome food and drink, excessive mental exertion, inordinate venery, exposure to cold, long-continued suppression of the cutaneous perspiration, and injury of the spinal cord, brain, or sacro-lumbar nerves. The immediate agency in its production is not yet entirely settled, but the experiments of Wöhler, Liebig, and Frerich, render it more than probable that it is due to the oxidation of the uric acid. Certain articles of food, such as rhubarb, sorrel, and tomato, also promote its appearance in the urine.

The *symptoms* of this affection are such as generally indicate the presence of derangement of the digestive, but more especially of the nervous functions. Dyspepsia often exists in a marked degree; flatulence is a common occurrence; the mind is often gloomy and despondent; the temper is fretful; the surface is exceedingly susceptible to external impressions; the extremities are almost constantly cold; the sleep is disturbed by disagreeable dreams; and the patient continually broods over his disease, having a thousand misgivings, and the most horrible forebodings; pain in the loins is a frequent symptom; the sexual power is usually much impaired; and the urine is often voided with uncommon frequency, as well as with more or less heat and smarting. As the disorder advances, the patient becomes excessively emaciated, and ultimately falls into a state of confirmed hypochondriasis. Serious pulmonary suffering is sometimes present, and in many cases the skin is covered with boils and scaly eruptions.

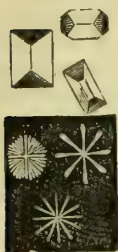
In the *treatment* of this disorder, the first thing to be done is to improve the general health. The diet should be regulated, and those articles which produce acidity and flatulence should be carefully avoided. The body should be well protected with clothing, and the skin should be rubbed daily with tepid salt water or some other stimulating fluid, and thoroughly rubbed with a coarse, dry towel, or a flesh brush. In warm weather cold ablutions may be used. If there is much debility, tonics are indicated, such as quinine and sulphate of iron, in combination with capsicum and hyoscyamus. Sulphate of zinc in the dose of one grain, two or three times a day, occasionally answers an excellent purpose. The mineral acids, as the dilute nitric and nitromuriatic, also possess valuable tonic properties.

3. The *phosphatic deposit* is characterized by its whitish color, by its pulverulent arrangement, by its solubility in dilute hydrochloric acid, and by its insolubility in ammonia and solution of potassa. It presents itself under three distinct varieties of form, the triple, the calcareous, and the mixed, each of which demands succinct notice.

a. The *triple phosphate* consists of phosphate of ammonia and magnesia, on which account it is generally called the ammoniaco-magnesian phosphate. It commonly occurs in minute white crystals of a beautifully brilliant aspect, transparent or opaque, and remarkable for

their sharp angles and edges. In their form, these crystals exhibit great diversity, but in most cases they are prismatic. Occasionally they have a stellar, penniform, or foliaceous arrangement (fig. 432). They often float on the surface of the urine, especially if it is partially decomposed, and look like an iridescent film of grease. The urine which accompanies this deposit is preternaturally copious, pale, or whitish, and of low specific gravity, ranging from 1.005 to 1.014. It has a faint, sickening smell, which soon becomes ammoniacal and offensive. In some instances of the affection the fluid is unnaturally dark, brownish or greenish-brown, decidedly alkaline, and loaded with dense, ropy mucus.

Fig. 432.



The triple phosphatic deposit very often alternates with the yellow lithic or calcareous. Old persons are more subject to it than children and adolescents, and it is always associated with great disorder of the digestive organs. The patient is weak, irritable, and bloodless; the slightest exercise fatigues him, and he complains constantly of a dull, heavy, aching pain in the lumbar region. Over-exertion, errors of diet, dyspepsia, severe courses of mercury, and excessive venery, are its most common exciting causes.

*b. The calcareous deposit* is composed of phosphate of lime, and occurs in the form of an impalpable powder, of a whitish, grayish, or drab color. The urine, as in the triple variety, is pale, copious, and of low specific gravity, and is readily decomposed by exposure to the atmosphere. The deposit is often accompanied by an inordinate secretion of mucus.

*c. The mixed deposit*, consisting of a combination of the two preceding, is very common. It is usually combined with mucus, which is often secreted in large quantity, and of a ropy, viscid character. The urine is fetid, pale, and abundant, depositing a thick mortar-like sediment upon standing. The most common causes of this condition are, injury of the lower part of the spine, organic disease of the kidney and bladder, dyspepsia, long-continued bodily fatigue, mental anxiety, night watching, unwholesome food, and debilitating medicines. Patients thus affected are weak, flatulent, irritable, nervous, easily affected by cold, emaciated, and of a gloomy, desponding disposition. The urine is voided more frequently than in health and with more or less pain and scalding along the urethra. Pain in the loins is seldom wanting.

In the *treatment* of this affection, the principal indications are, first, to improve the condition of the digestive organs; secondly, to acidify the urine; and, thirdly, to strengthen the system. To accomplish the first of these objects, it is necessary to regulate the diet, and administer mild aperients. Hard water should be avoided. Exercise should be taken daily in the open air, but it must never be carried so far as to induce fatigue. The skin should be frequently bathed.

To fulfil the second indication, acids are required, of which the dilute nitric is the best. It may be administered by itself, in a large quantity of water, or, what is generally preferable, in union with hyoscyamus, black drop, paregoric, or infusion of opium. Anodynes can



rarely be dispensed with, and are often of immense benefit, from the manner in which they allay pain and nervous irritation. In some instances the tincture of the chloride of iron proves useful. When the urine is rendered preternaturally acid, or when there is marked pyrosis, recourse must be had to soda, or soda and potassa, along with uva ursi and hop-tea. All diuretics, properly so called, are injurious.

The third indication is fulfilled by the use of tonics, such as quinine, bark, and steel, a plain, but generous diet, exercise in the open air, and change of residence. A sea-voyage is sometimes highly beneficial. Exposure to cold, irregularities of diet, and indiscretions of every kind, should be avoided, both during the actual existence of this diathesis, and for a long time afterwards, on account of the great tendency to relapse.

When the deposit depends upon lesion of the spinal cord, the internal use of strychnine and counter-irritation, in the form of blister, issue, or the hot iron, will be of benefit. If inflammation of the bladder or kidney exist, it must be combated by the ordinary means.

#### STONE IN THE BLADDER.

Most urinary calculi originate in the kidneys, from which they descend into the bladder, where, if they are retained for any length of time, they gradually increase in size, and ultimately produce more or less obstruction. Their progress along the ureter is sometimes slow and painful; at other times rapid and almost free from suffering. The amount of the local distress is greatly influenced by the nature of the concretion, and by the degree of resistance afforded by the ureter. A small, smooth calculus usually causes little inconvenience; while a large or rough one often occasions exquisite torture. The process of descent, which generally occupies from twelve to forty-eight hours, is characterized by excessive nausea and vomiting, great restlessness and jactitation, pain in the back, groin and thigh, retraction of the testicles, numbness along the spermatic cord, a sense of constriction at the umbilicus, and tenderness of the hypogastrium, with coldness of the extremities, rigors, and a feeling of excessive prostration. The urine gradually accumulating behind the calculus, the ureter is slowly dilated, and the concretion at length reaches the bladder, from which it is either ejected, or it remains there until removed by operation. As soon as the passage is completed, the pain and sympathetic irritation subside, the patient frequently falling into a tranquil and refreshing sleep. The descent of the calculus may be expedited, and rendered less painful, by the abstraction of blood from the arm, the loins, or hypogastric regions, large doses of morphia, along with castor oil and turpentine, the hot bath, fomentations, and anodyne injections. The free use of chloroform, by inhalation, will also prove highly beneficial.

Stone occurs at all *ages*. I have met with several examples of it in very young infants, and cases have been related which render it highly probable that it is occasionally an intra-uterine affection. In my Treatise on the Urinary Organs are given the ages of 6,042 cases of stone in the bladder, as occurring in England, France, and Russia,

of which 2,334 were observed from the first to the tenth year, 1,079 from the tenth to the twentieth, 513 from the twentieth to the thirtieth, 353 from the thirtieth to the fortieth, 422 from the fortieth to the fiftieth, 536 from the fiftieth to the sixtieth, 587 from the sixtieth to the seventieth, 201 from the seventieth to the eightieth, and 17 from the eightieth to the ninetieth. Thus, it will be seen, that more cases occur prior to the age of twenty than at all other periods together.

In attempting to form a correct estimate of the relative frequency of calculous complaints in children, adults, and old persons, we must not lose sight of the fact that many of the cases which fall into the hands of the surgeon are examples of long standing, extending, perhaps, through a period of many years. Thus, a man at forty may have contracted the disease at ten or fifteen. Moreover, it should be borne in mind that calculous diseases are more frequent, in certain countries, among children than among adults, and conversely.

It is not satisfactorily ascertained whether this affection is ever *hereditary*. Cases related by Civiale and Prout seem to warrant the inference that it is; but I have myself not met with any confirmatory evidence.

Stone in the bladder is very uncommon in *females*, owing, mainly, to their having a much shorter and more capacious urethra, which thus favors the excretion of any deposits that might otherwise form in the bladder. It has been alleged that this immunity is due to the fact that women are much less exposed to the exciting causes of the disease than men; but this conclusion is invalidated by the circumstance that at least one-third of all the cases of stone that are met with occur in boys before the tenth year, and, consequently, before they are subjected to any particular hardships.

The different varieties of the *negro* race of this country are much less subject to calculous diseases than the whites. I have ascertained from reliable statistics, founded upon 443 cases of stone in the bladder occurring in Kentucky, Virginia, Tennessee, Georgia, Alabama, Louisiana, and Missouri, that the latter suffer three times as frequently as the former. The same fact disproves the idea, so much insisted upon by certain writers, that the use of corn bread and bacon, which constitute a large proportion of the daily food of the colored population, in the above regions, is favorable to the production of urinary calculi.

Stone in the bladder occurs in all parts of the *world*, though by no means with equal frequency. In the United States it is more common in Kentucky, Virginia, Tennessee, and Ohio than in any other parts of the country. New England is remarkably exempt from it. The disease is sufficiently common in France, Austria, Hungary, Russia, and England. The inhabitants of Ireland, Spain, and Switzerland, on the contrary, suffer from it comparatively seldom. In Holland, calculus of the bladder is much less frequent now than it was a hundred years ago.

The causes of these topographical differences in regard to the occurrence of stone in the bladder have not been determined. The great prevalence of the disease in limestone regions has long been familiar to observers, but whether the use of limestone water has really any agency in its production, is still a mooted question. It is certain that it frequently occurs in freestone regions.

It has long been known that calculous diseases are much more common among the *poor* than the rich. Upon what this difference depends, is not positively ascertained; but the probability is that it is mainly due to derangement of the digestive organs, engendered by the use of unwholesome food, by irregular habits, want of cleanliness, intemperance, and deficient clothing.

*Occupation*, no doubt, exerts an important influence upon the production of this disorder, but in what manner, or to what extent, is unknown. In Ohio, and the Southwestern States, especially Kentucky, Tennessee, and Alabama, the great majority of calculous subjects are common laborers, farmers, and mechanics, or the sons of persons of this description. Seafaring people are remarkably exempt from urinary calculi, and a similar immunity seems to be enjoyed by soldiers.

*Climate*, also, exercises no little influence in the formation of urinary concretions. Thus, it is well known that the disease is most common in those parts of the world which are subject to frequent, great, and sudden atmospheric vicissitudes. In very cold and tropical regions, on the contrary, it is exceedingly rare.

Certain kinds of *food* predispose to the formation of calculous disease. All articles which have a tendency to create acidity and flatulence, exert a deleterious influence upon the renal secretion, changing its properties, and promoting the deposition of earthy matter. Hot bread, in its various forms, frequently only half-baked, and generally very imperfectly masticated, is sufficient, if used for any length of time, to wear out the strongest stomach, and to break down the most vigorous frame. A weakened digestion, with a sour and flatulent state of the stomach, constipation of the bowels, and an irritable condition of the brain, cannot by any possibility produce a healthy blood, any more than a morbid state of the blood can produce a healthy urine.

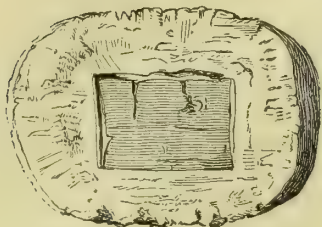
Various kinds of *drinks* exert an influence favorable to the formation of stone in the bladder. It has long been remarked in England that those districts in which cider is much employed are remarkably prone to calculous disorders. On the other hand, it is alleged that the use of Rhenish wine and of gin acts as a preventive.

The formation of stone in the bladder is remarkably favored by certain kinds of *diseases*, especially stricture of the urethra, chronic enlargement of the prostate gland, and organic affections of the bladder, ureters, and kidneys. Injury of the spinal cord, particularly when it involves the dorso-lumbar portion of that structure, or the nerves detached from it, is extremely prone to be followed by phosphatic deposits; and it has long been known that gout and rheumatism are eminently conducive to the formation of uric acid calculi.

*Physical Properties*.—Most calculi have a distinct *nucleus*, round which the earthy matter accumulates and crystallizes. The nucleus may be formed of any substance, either solid or semi-solid, whether generated in the urinary organs, or introduced from without. In general, it consists of some saline matter of the urine, as uric acid, oxalate of lime, or phosphate of lime and magnesia. Inspissated mucus, lymph, hair,



Fig. 433.



or clotted blood, may serve a similar purpose. In my private collection are specimens in which the concretions were formed round the tail-bones of a squirrel, an elm bougie, a piece of lead pencil, and a bullet, the latter having been kindly presented to me by Dr. Robinson, of Warfordsbury, Pennsylvania. In the adjoining cut (fig. 433), from a preparation in the cabinet of Dr. Sabine, of New York, the nucleus consists of a piece of

cork. Professor Van Buren informs me that he has a calculus which was formed round an ear of wheat. Finally, the nucleus varies much in size, color, shape, and consistence; and, although generally single, it is sometimes double, triple, and even quadruple.

The *number* of concretions is variable. In general, there is only one, but there may be several dozen, if not several hundred. The largest number I have ever found was fifty-four. Physick, in one case, met with upwards of one thousand, from the size of a partridge shot to that of a bean.

The mulberry calculus is almost always solitary; and the same is true, but not to the same extent, of the uric calculus. The phosphatic calculus, on the contrary, is not unfrequently multiple. When the concretions are numerous, they are generally proportionably small and smooth on the surface. When, on the contrary, they are solitary, they are generally rough and comparatively large.

The *volume* of urinary concretions ranges from a hemp seed to a goose's egg. In young subjects, and in recent cases generally, it is usually inconsiderable. The size of a urinary concretion, however, does not necessarily depend upon the period of its sojourn in the bladder, or the age of the patient. Occasionally, it increases very rapidly, so as to attain a large bulk in a very few months; and, on the other hand, it may remain small for many years.

The ammoniaco-magnesian, and the fusible calculi, are capable of attaining a very large size, while the uric, oxalic, cystic, xanthic, and fibrinous, are almost always comparatively small, no matter what may be their age, or the age of the patient. This fact is interesting in a practical point of view; because, by ascertaining the calculous diathesis of the sufferer, we shall be able to form a tolerably correct idea of the volume of the stone under which he is laboring.

The *weight* of urinary concretions does not, in general, exceed a few drachms or ounces. Many examples, however, are recorded of four, six, eight, ten, twelve, fifteen, and even sixteen ounces. Deschamps gives a case of fifty-one ounces.

The *consistence* of vesical concretions, as a general rule, varies from that of semi-concrete mortar, chalk, or wax, to that of stone. The hardest calculi are the oxalic and uric, which commonly emit a clear sound when struck with steel, and cannot be fractured without a considerable degree of force. Calculi, on the other hand, composed of ammoniaco-magnesian phosphate and phosphate of lime, are friable, and

easily reduced to powder. The cystic and fibrinous calculi are quite soft, the latter scarcely equalling that of yellow wax. In what are termed alternating calculi, one part of the stone will commonly be hard and compact, while another is soft and friable, if not pulverulent.

Stones are occasionally composed of a mixture of sabulous matter and hair. Their formation is of rare occurrence, and they appear to consist, principally, of phosphate of lime and magnesia.

The *color* of these bodies is variable. The cystic and fibrinous calculi are of a yellow hue; the phosphatic are whitish or grayish; the oxalic, dark, or blackish; the uric, rose, reddish, or brown.

Vesical calculi assume a great variety of *forms*. The circumstances which are chiefly concerned in producing this result are the action of the bladder, the friction which the concretions, when multiple, exert upon each other, and the nature of the nucleus. Finally, it is not unlikely that the chemical constitution exerts more or less influence upon the form of the stone.

Vesical calculi are generally of an oval form, but they may be round, or even angular, or cylindrical. Sometimes several are matted together, so as to form what, geologically, is termed a pudding-stone. Dr. Mussey showed me, some years ago, a very curious calculus, illustrated in the adjoining cut (fig. 434), which had been removed after death from the bladder of a man who had long labored under disease of that organ. It is of a light-brownish color, and consists of a central portion and a number of distinct processes, each of which has a small cavity containing animal matter. The processes are remarkably rough, and several of them are nearly half an inch in length. Its composition is supposed to be oxalate of lime. Occasionally the concretion consists, apparently, of two parts, one corresponding with the bladder, and the other with the urethra, as is seen in fig. 435.

The *surface* of these concretions may be smooth or rough. The oxalic calculus derives its common name from the irregularity of its surface, which resembles that of a mulberry. The uric acid calculus is usually finely tuberculated.

*Chemical Properties.*—The composition of urinary calculi has deservedly engaged much attention. The subjoined account includes the most important species that have yet been described.

The *uric* calculus, called also the lithic calculus, the most common species of all, is of a brownish color, inclining to that of mahogany, of a flattened, oval shape, occasionally finely tuberculated on the surface, but most generally smooth, though not polished, unless there are

Fig. 434.



Fig. 435.



*a*, shows the vesical, and *b*, the urethral portion.

several concretions at the same time, and from the size of a currant to that of a hen's egg. If it be sawed, it will be found to consist of several layers arranged concentrically around a common nucleus, the laminae being frequently distinguishable from each other by a slight difference in color, and sometimes by the interposition of other ingredients. Water has but little action upon it; it is perfectly dissolved by caustic potassa; and disappears with effervescence in hot nitric acid, the solution affording, on evaporation to dryness, a bright carmine-colored residue; before the blowpipe, it becomes black, emits a peculiar animal odor, and is gradually consumed, leaving a minute quantity of white, alkaline ashes. Fig. 436 shows the oval shape and finely tuberculated surface of the calculus; fig. 437 the internal concentric layers.

Fig. 436.



Fig. 437.



The *uro-ammoniac* calculus is a variety of the preceding. It is principally observed in children, and is extremely rare. It is generally of small size, with a smooth surface, of a clay color, and composed of concentric rings, which present a very fine earthy appearance when fractured. Much more soluble in water than the uric calculus, it gives out a strong ammoniacal smell when heated with caustic potassa, and deflagrates remarkably under the blowpipe.

Next to the uric calculus, in point of frequency, is the *oxalic*, which is generally of a dark brown color, rough and tuberculated on the surface, very hard, compact, and imperfectly laminated, seldom larger than a walnut, spherical, and always single. Under the blowpipe, it expands and effloresces into a white powder, while it dissolves slowly in nitric and hydrochloric acid, provided it be previously well broken up. In the alkalis, it is perfectly insoluble. This species of urinary concretion, called by many the *mulberry* calculus, from its resemblance to the fruit of the mulberry, consists essentially of oxalate of lime. Figs. 438 and 439 show the external appearance and internal structure of this concretion.



Fig. 438.

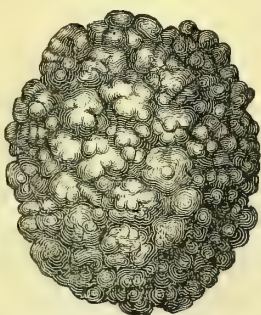


Fig. 439.



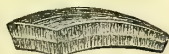
A variety of this species of calculus has been described by the term *hemp-seed*, from some resemblance which it bears in color and lustre to that substance (fig. 440). It is always of small size, remarkably smooth, and generally exists in considerable numbers, being rarely, if ever, found alone.

Fig. 440.



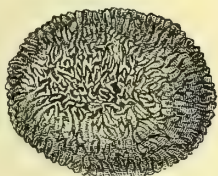
The *phosphatic* calculus (fig. 441), is of a pale brownish color, and of a loosely laminated structure, with a smooth, polished surface, like porcelain. The shape is mostly oval, and the size, though generally small, is sometimes very considerable. It whitens when exposed to the blowpipe, but does not fuse; and readily dissolves in hydrochloric acid, without effervescence. This calculus, composed essentially of phosphate of lime, is extremely rare, as forming entire concretions, but frequently constitutes alternate layers with other matters. It is sometimes called the *bone-earth* calculus, and occasionally contains small quantities of carbonate of lime.

Fig. 441.



The next species is the *ammoniaco-magnesian*, so called from its being composed of phosphate of ammonia and magnesia (fig. 442.) This mixed calculus is of a white color, friable, and crystallized on the surface, looking a good deal like a mass of chalk; its texture being never laminated, it easily dissolves in dilute acids, but is insoluble in caustic potassa; before the blowpipe, it exhales an ammoniacal odor, and at length melts into a vitreous substance. This species of concretion sometimes attains an immense size.

Fig. 442.



The *fusible* calculus consists of a combination of the last two. It is of a white color, extremely brittle, leaves a soft dust on the fingers, and is easily separated into layers; when broken, it presents a ragged, uneven surface. It is insoluble in caustic potassa, but gives off ammonia; and, under the blowpipe, it is readily converted into a transparent, pearly-looking glass. This concretion is very common, and sometimes attains a very large size. It is frequently met with as an incrustation of foreign bodies. Figs. 443 and 444 exhibit the outer appearance and internal structure of this concretion.

Fig. 443.



Fig. 444.



The *cystic* calculus is a very rare species of concretion, so called from an erroneous supposition that it was peculiar to the bladder. It consists of a confused, crystallized mass, of a yellowish-white color, with a smooth surface. The structure is compact, and the fracture exhibits a peculiar glistening lustre, like that of a body having a high refractive density. It exhales a strong characteristic odor under the blowpipe, and is very abundantly dissolved in acids and alkalies, with both of which it crystallizes. This species is commonly of an irregular, spherical shape, and seldom attains a large volume. The external and internal appearances of the cystic calculus are shown in figs. 445 and 446.

Fig. 445.

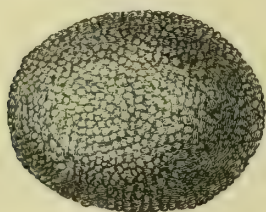
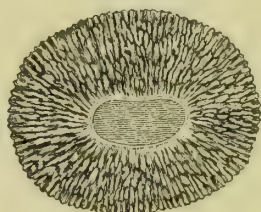


Fig. 446.



The *xanthic* calculus is extremely rare. Its texture is compact, hard, and laminated; its color is of a cinnamon brown, its surface smooth, and its volume small. It dissolves very readily in acids and alkalies, and is gradually consumed before the blowpipe, leaving a minute quantity of white ashes.

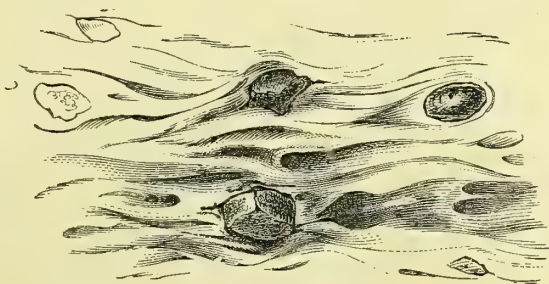
There is, lastly, what is called the *fibrinous* calculus. Like the preceding species, this is also extremely rare, and appears to be composed principally of the fibrin of the blood, a property to which it owes its name, and by which it is characterized. It is of small size, of a spherical or oval shape, and of a brownish color. When dried, it shrinks, and loses some of its weight.

*Situation.*—Calculi lie generally loose within the cavity of the bladder, and are, consequently, liable to shift their position, not only with that of the viscus in which they are contained, but also with that of the body. Hence at one moment they may be at the bas-fond of the organ, at another at the neck, at another at its superior portion or base, at another at its sides, and at another, perhaps, at its anterior part, just above or behind the pubes. A knowledge of this variation, in the position of these foreign substances, is of no little importance in regard to the operation of sounding. Their most common situation is, undoubtedly, the bas-fond of the bladder, from the fact that this is the most dependent portion of the reservoir. In old subjects, affected with enlargement of the prostate, the concretion generally lies just behind this body, in a sort of pouch, hollow, or cul-de-sac. When this is the case, and the calculus is of large size, it may often be easily felt by the finger in the rectum. When the bladder is perfectly sound, the concretion, especially when the patient is in the erect position, and the urine evacuated, rests against the neck of the organ, and sometimes even projects into the orifice of the urethra.

Cases occur in which the concretion is alternately loose and fixed. This may be owing to the existence of an abnormal pouch. The foreign body may also be arrested in the folds of the mucous membrane, in a depression behind the prostate, in the substance of this gland, in the orifice of the ureter, or in the mouth of the urethra.

Vesical calculi may become permanently *adherent*, attached, or fixed, as exhibited in fig. 447, from a specimen formerly in the University

Fig. 447.



Encysted calculi.

of Louisville. This may take place in different ways, and under a variety of circumstances, of which the following may be mentioned as the most important: 1. An effusion of coagulating lymph; 2. The formation of an abnormal pouch; 3. The existence of a fungous tumor or excrescence; 4. A bilobed state of the bladder; 5. The projection of the concretion into the ureter, or some other passage; 6. Its lodgment in the wall of the bladder.

Finally, the calculous matter, instead of being collected into a distinct concretion, is sometimes spread out in the form of a *layer* upon the bas-fond of the bladder. A layer of this kind, of considerable thickness, now and then forms around a spongy, erectile, or fibrous tumor of this organ. When the calculous matter presents this peculiar



arrangement, it grates under the instrument, and can be distinctly felt through the rectum. When struck with the sound it emits a peculiar noise, not unlike that of a cracked pot. I have seen several specimens in which this lamelliform arrangement co-existed with separate calculi.

*Symptoms.*—The symptoms of stone in the bladder may be conveniently divided into the rational and physical. They may be divided, also, into local and general, as they affect the urinary apparatus or the system at large.

The rational symptoms are: 1. Pain in making water, especially when the last drops are being expelled, felt both in the bladder and the adjacent parts. 2. A sense of weight and uneasiness in the pelvis, anus, and perineum. 3. Frequent micturition. 4. An occasional interruption of the stream of urine. 5. Pain and itching in the head of the penis, with smarting and pricking sensations in the urethra, particularly at its orifice. 6. Enlargement of the penis and elongation of the prepuce. 7. Occasional priapism, with or without sexual desire. 8. An increased secretion of mucus, from the lining membrane of the bladder. 9. A bloody state of the urine. 10. Incontinence of urine. 11. Prolapse of the anus. 12. Sympathetic suffering. 13. Noise furnished by the calculi knocking against each other in the bladder.

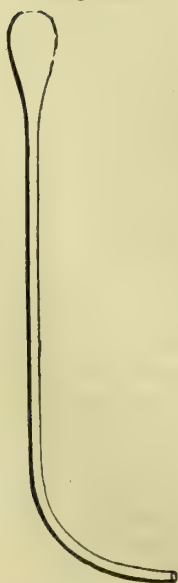
The above symptoms usually come on gradually, and a considerable period often elapses before the patient is led to suspect the real nature of his condition. This is especially the case when the general health is good, and the bladder perfectly sound. Indeed, under such circumstances, the organ may, for a long time, take no cognizance of the presence of the foreign body.

*Physical Signs—Sounding—Diagnosis.*—When the symptoms above described are all present, or even when several of them are absent, there is a strong probability that the patient is laboring under stone of the bladder, and this probability is converted into certainty when the surgeon is able to feel and hear the foreign body. Nevertheless, cases occasionally occur, in which, notwithstanding the existence of both rational and physical signs, no concretion is to be discovered.

Sounding consists in introducing into the bladder an instrument shaped like a catheter, either solid or hollow, with which the cavity of the organ is explored. The instrument itself is called a sound.

Sounds vary in their construction, in their size, and in the materials of which they are composed. The best are solid, well polished, and made of steel, with varying degrees of curvature. For an adult, the length from one extremity to the other should be about twelve inches, of which two inches and a half should be allowed for the handle (fig. 448). Children, of course, require a shorter instrument. Generally speaking, a sound of moderate diameter is preferable to one of large size, as it is more easily moved about in the bladder. The vesical extremity,

Fig. 448.



or beak, should be rounded off, not conical, or pointed, so that it may not be liable to be arrested by the irregularities of the urethra. The curved portion should not, as a general rule, exceed three inches, and should form an angle of about  $45^{\circ}$  with the straight portion. The handle of an adult sound should not be less than two inches in length, by one inch and an eighth in width; it should taper somewhat towards the stem of the instrument, be about a line in thickness, rounded off at the corners, and well polished. Every lithotomist should be provided with several sounds, of various sizes and curvatures.

Previously to sounding, the bowels should always be well cleared out with castor oil, or a purgative enema.

The bladder, at the time of the exploration, should contain from three to five ounces of urine, or, if it be too irritable to retain that quantity, or if the patient has urinated inadvertently, the requisite distention should be produced by the injection of tepid water, through a silver catheter, which may then be used as a sound, care being taken to stop up its orifice, to prevent the regurgitation of the fluid.

During sounding, the patient should lie upon his back, with his head and shoulders somewhat elevated, and the lower extremities slightly fixed and separated, to relax the abdominal muscles. Adults are sometimes sounded in the erect posture; children never, except under particular circumstances. The surgeon comports himself precisely as in catheterism.

Frequently the sound encounters the stone the moment it enters the neck of the bladder; but should this not happen, it must be passed further in, and moved about in different directions until the object is accomplished.

The pubic surface of the bladder can be reached only by an instrument with a very long curve, not unlike that of the English S. Very frequently the stone cannot be felt, in consequence of its lying in a pouch, in the bas-fond of the organ, just behind the prostate. When this is the case, the index-finger of the left hand, properly oiled, is introduced into the rectum, and the foreign body pushed forwards against the sound. When the difficulty is very great, an instrument with a short, abrupt curve (fig. 449), may be used. Sometimes it is necessary to change the position of the patient, making him lie on his side, sit or stand, bend forwards, or raise his buttocks.

The crying and struggling of children may be quieted by the use of chloroform, which I am in the habit of employing in nearly all cases of the kind, both for the purpose of preventing pain, calming the patient's mind, and quieting the bladder.

The noise and sensation communicated by sounding are peculiar. The noise is a sort of click, clink, or clear metallic resonance. It is in the highest degree valuable as a diagnostic sign. It may often be perceived at a distance of several yards from the patient. A grating,

Fig. 449.



rubbing, or friction sensation is sometimes distinguished, but this is rather indicative of a fasciculated state of the bladder, a morbid growth, or an incrustated condition of the mucous membrane than of the existence of stone.

Patients are often brought to the surgeon from a distance to be lithotomized. When this is the case, they should not be sounded until they have recovered from their fatigue. Nor should the operation be performed during or immediately after a "fit of the stone." The system should be prepared for the operation. From neglect of this precaution, patients are often subjected to much suffering, and I believe that life has been repeatedly sacrificed in this way.

The sounding should be conducted with the utmost gentleness, and should never be continued beyond a few minutes at a time.

When the stone is very small, or the feel and noise elicited are very feeble, recourse may be had to auscultation. This may be done by applying the stethoscope either to the pubic region, to the sacrum, or to the perineum; at the same time that the sound is moved about in the bladder.

Sounding enables us not only to detect the presence of a calculus in the bladder, but it frequently furnishes important data in regard to its bulk, situation, and consistence, and as to whether it is single or multiple, rough or smooth, loose or attached.

Another object in sounding is to ascertain the condition of the urinary apparatus. This can frequently be accomplished in no other manner. The capacity of the organ, and the amount of its sensibility or tolerance can thus be discovered.

Moreover, we can generally determine, with considerable accuracy, by such a mode of exploration, whether the inner surface of the bladder is smooth or rough, ulcerated or fasciculated, incrustated with lymph or sabulous matter, or studded with fungous, fibrous, or other morbid growths. The passage of the sound along the urethra enables us to judge whether this tube is healthy or diseased, contracted, changed in its direction, or obstructed by the presence of a foreign body. The condition of the prostate gland is best determined by the finger in the bowel. The anus and rectum should also be carefully examined.

Although sounding is the only certain way of detecting the presence of stone, it is by no means free from *error*, as is proved by the fact that many a poor patient has been subjected to all the pains and penalties of lithotomy, when the bladder was perfectly free from everything of the kind. I am cognizant of at least half a dozen cases in which this mistake was committed. The circumstances which may give rise to it differ very much in their character, some being dependent upon the bladder itself, others upon the neighboring parts, as the prostate gland, rectum, uterus, vagina, and pelvic bones. Mere irritability of the bladder, attended with a frequent desire to void the urine, may lead to the supposition of the existence of stone, and if the surgeon, anxious for the eclat of an operation, should, in such an event, strike his sound against a mass of impacted feces, a projecting sacrum, or a morbid growth in the bladder or pelvis, he would be very apt to deceive himself. The greatest possible circumspection should, there-



fore, always be used in sounding, the operation, if necessary, being performed again and again, until it is perfectly certain that a stone really exists.

On the other hand, it is well known that there may be a stone in the bladder, and yet the surgeon be unable to detect it by sounding, aided, perhaps, by all the auxiliary means he can command. This failure has frequently occurred, even where the concretion has been uncommonly large, and where the operation has been repeatedly performed with the greatest care and skill, and varied in every possible manner. Want of success has sometimes attended, even where the calculi were multiple, or where a considerable number coexisted. Again, it has happened that a stone has been promptly detected in a first sounding, and, perhaps, not at all, or only after much trouble, in a subsequent one. Or the reverse of this may occur, that is, the concretion may elude the instrument in a first and second sounding, but be always readily detected afterwards. It is with sounding as with everything else. To perform it well requires great tact in the use of instruments, a perfect knowledge of the anatomy of the urinary apparatus, and a degree of experience which multiplied observation alone can supply. But the want of success, in this operation, is not confined

Fig. 450.

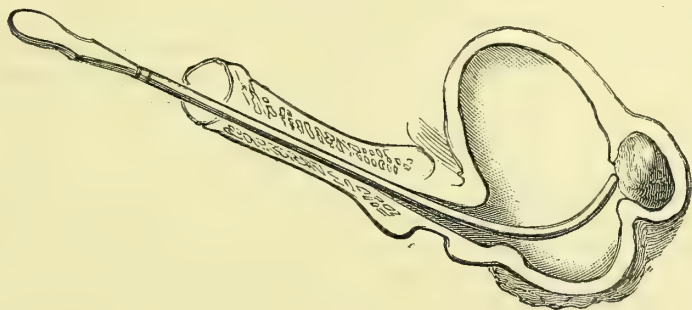
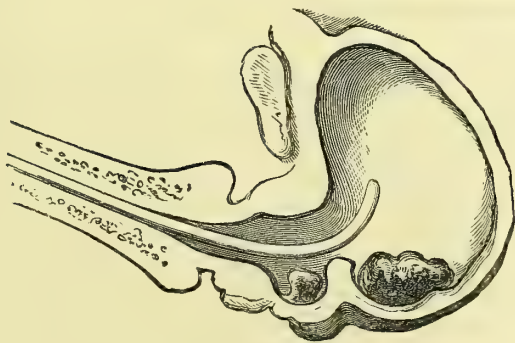


Fig. 451.



exclusively to the young, the ignorant, or the unskilful. Men of the most consummate dexterity have occasionally failed in detecting a stone, when a stone really existed.

Of the various circumstances which may prevent the detection of urinary calculi, some relate to the stone itself, some to the bladder, and some to the neighboring and associate organs. Thus, the foreign body may be very small, or there may be too much or too little water in the bladder during sounding; or it may be encysted, as in fig. 450, or lodged in a cul-de-sac, at the bas-fond of the bladder, just behind the prostate gland, as seen in fig. 451. Sometimes, again, the concretion lies in a dilated ureter, or in a pouch in the prostate gland.

*Pathological Effects.*—Although the formation of vesical calculus is the immediate result of a morbid condition of the urinary secretion, the bladder and its associate organs are generally diseased, to a greater or less extent, in the progress of the affection. The primary impression is probably always made upon the viscus in which the concretion is confined; but the irritation which its protracted presence there induces is gradually reflected upon the other portions of the apparatus, awakening in them, in the first instance, important sympathetic actions, and, ultimately, serious structural lesions.

One of the first effects to which the foreign body gives rise, is inflammation of the mucous coat of the bladder, as indicated by a frequent desire to make water, spasmodic pains in the lower part of the pelvis, and an increased secretion of mucus. Thickening of the lining membrane with increased vascularity, and the development of granulations is another effect; and the irritation extending to the different coats of the bladder, hypertrophy of the organ may take place. A diminution in the size of the bladder is not infrequent even in young subjects, but is much more common in old persons, who have labored for years under the continued irritation of a calculus. Ulceration of the mucous coat is another effect of stone in the bladder. It is most frequently observed at the neck and bas-fond of the organ.

One of the most distressing accidents which take place, during the progress of this disease, is perforation of the bladder, followed by a partial or complete escape of the stone, and the formation of a fistule. When it is accompanied by extravasation of urine into the surrounding cellular tissue, it may terminate fatally in a few days, or lead to violent inflammation and suppuration, inducing death at a more distant period.

The urethra rarely suffers except in its prostatic portion, which may be unnaturally red, inflamed, hypertrophied or attenuated. The prostate gland soon becomes diseased. It gradually increases in volume and density, sometimes enlarging in every direction, impeding the flow of urine, augmenting the pain and spasm of the bladder, and even producing serious pressure upon the rectum. Ulceration, abscess, and sloughing may follow from the constant and excessive irritation. In some instances the prostate is converted into a cavity, nearly equal to that of the contracted bladder itself, and capable of lodging a calculus of considerable size.

The ureters are frequently reddened and thickened, sometimes ulcerated, and now and then enlarged, or enlarged at one place, and contracted at another.

The kidneys rarely entirely escape in this disease. In the worst

form of the malady, it is not unusual to see one of them converted into a large pouch filled with purulent matter, or turbid urine.

Abscesses and fistules occasionally form in the perineum. Prolapse of the anus takes place, attended with relaxation of the sphincter muscles, inflammation and thickening of the mucous membrane, and hemorrhoidal tumors.

The orifices of the seminal ducts are, in many cases, dilated, or otherwise affected, and the ducts themselves may be variously altered. The seminal vesicles are sometimes atrophied, or diminished in volume, and changed in structure.

It may be mentioned, in this connection, that a calculus of the bladder has sometimes obstructed parturition, and required extraction before the labor could be completed.

Finally, another effect which occasionally occurs is the spontaneous fracture of the calculus, succeeded by violent irritation of the bladder, and sometimes even the death of the patient. The immediate cause of fracture of urinary calculi within the bladder is, no doubt, the inordinate contraction of the muscular fibres of this organ.

#### TREATMENT OF STONE.

The treatment of stone in the bladder necessarily divides itself into medical and surgical, of which the former is, in general, merely palliative, though frequently of paramount importance, whether it be considered only in reference to the temporary comfort of the sufferer, or as a means of improving his health, with a view to his relief by an operation.

##### 1. MEDICAL MEANS.

Persons affected with stone in the bladder do not always find it convenient to submit to the operation of lithotomy, and it, therefore, becomes a matter of great importance to render them as comfortable as their circumstances may admit of. By attention to the general health, as regulated by food, drink, and exercise, much may be done to allay local suffering, and make the patient almost forget his disease. A concretion, which may have been a source of great distress for years, may, by appropriate and well-directed treatment, become a comparatively harmless tenant of the bladder, and thus convert a state of torture into one of elysium. The improvement thus produced has sometimes lasted many years, though, in general, it is comparatively short. A consideration of these circumstances has led to a belief, not altogether unfounded, that urinary concretions are sometimes dissolved in the bladder, and voided along with the urine. Hence certain remedies, supposed to be endowed with this property, have received the name of lithontriptics, or solvents and disintegrators of stone.

Much of what might be said under this head has been anticipated in the article on the different calculous deposits.

It is hardly necessary to remark that a due regulation of the *diet* is of paramount importance in the treatment of stone in the bladder. Without entering into details, it may be observed, in general terms,



that the diet should be simple, easy of digestion, and yet sufficiently nutritious. Plainly roasted meats, boiled fish, mealy Irish and dry sweet potatoes, well boiled rice and hominy, soda biscuit, and stale wheat bread, with weak tea, or milk and water, are, ordinarily, the most suitable articles. Coffee, wine, fermented liquors, cider, and subacid fruits, with pastry, and the coarser kinds of vegetables, are to be eschewed. If the patient be feeble, or has been in the habit of using liquor, a little French brandy, or, what is better, Holland gin, may be allowed at dinner, and after exercise. Gin, as is well known, has a sort of specific tendency to the urinary organs, and its exhibition is occasionally attended with good effects. Some persons, are greatly benefited by hop-tea, beer, or malt liquors. Generally speaking, however, these articles produce more harm than good. All kinds of water impregnated with lime must be abstained from. The patient should be well clad, avoid exposure to wet and cold, and refrain from rough exercise of every description. In the winter he should keep himself well housed, or reside, if possible, in a warm and genial climate. Sexual excitement must be carefully guarded against, for any indulgence of the kind is always sure to be followed by an aggravation of the complaint.

The urine must, in all cases, be kept in as neutral a condition as possible. If it be acid, alkalies are indicated, whereas if it be alkaline, acids are required. Frequent examinations of the fluid are, therefore, necessary, in order that the remedies may be varied as the circumstances of each particular case may render it proper. It should be remarked here that some patients are most benefited by alkalies, others by acids, even when the urine and the stone are both apparently of the same character. In my own practice I have generally derived most benefit from the use of alkaline remedies, whatever may have been the nature of the diathesis or of the concretion.

The best alkalies in the treatment of vesical calculi are soda and potassa, in the form of bicarbonate, either alone, or variously combined with each other. I usually give the preference to the soda, for the reason that it seems to me to exert a more obtunding effect upon the mucous surfaces of the urinary passages. The best form of exhibition is in solution in a strong infusion of hops and uva ursi, in the proportion of thirty grains to the ounce, three or four times a day. The best period for using the medicine is about one hour after meals, and at bedtime. Administered in this way, it readily mixes with the ingesta, prevents the evolution of acidity and flatulence, and exerts a more controlling influence over the urinary secretion. The quantity of the salt may be gradually increased to forty, fifty, and even sixty grains, according to the tolerance of the stomach; and a good plan is to premit the use of it occasionally for a few days. Carbonate of potassa is sometimes employed alone, but its beneficial influence is always greatly enhanced by giving it in union with soda. The liquor potassæ now and then answers an excellent purpose in these cases, particularly in persons of a dyspeptic habit. It should be administered, largely diluted with water, in doses varying from twenty to forty drops, three times daily, or, what is better, under such circumstances,

in combination with some of the simple bitters, as tincture of gentian, quassia, or cinchona. Some patients derive much relief from the free use of lime-water, castile soap, magnesia, and lye.

Marked benefit, sometimes of a permanent character, springs from the long-continued use of certain mineral waters. Of the various waters celebrated for their virtue of solving calculi and soothing the bladder, those of Vichy, in France, are the most remarkable, on account of the numerous cases that have been relieved by their use. The Vichy waters contain a large quantity of free carbonic acid, and very nearly a drachm and a half of bicarbonate of soda in every thousand drachms of the menstruum, upon the presence of which their good effects, no doubt, depend.

When the urine is decidedly alkaline in its character, acids are indicated. Those usually employed are the nitric and hydrochloric, of which the former is preferable. The best form of exhibition is the dilute nitric acid of the shops, in doses of from twenty to thirty drops, three times daily, in nearly half a tumblerful of cold water, sweetened with a little sugar.

Attempts have been made, from time to time, to dissolve urinary calculi in the bladder by means of injections of acid and other fluids, but the results have not been such as to encourage a repetition of the operation, now that the subject is so well understood. The same remark is true in regard to the effects of galvanic electricity, proposed by some French surgeon.

## 2. EXTRACTION OF CALCULI THROUGH THE URETHRA.

The fact that small calculi sometimes escape during micturition was long ago noticed by practitioners, and has been turned to good account by modern surgeons. When it is known, for example, that a concretion has recently descended from the kidney, its expulsion from the bladder may occasionally be effected by making the patient grasp the head of the penis, while he distends the urethra with urine; then, letting go his hold, he empties his bladder with all the force he can direct upon it by the action of the diaphragm and abdominal muscles. The water should be previously accumulated to the greatest possible extent, and, during its evacuation, the patient should lie upon his belly, or bend his body forward, to place the stone in the most favorable position for reaching the urethra. These attempts at extrusion are much facilitated by the prior dilatation of the tube by means of the bougie or catheter.

Efforts have been made, especially in recent times, to remove calculi entire from the bladder, through the urethra, by means of forceps. It was observed, long ago, that, during catheterism, small concretions became occasionally impacted in the eyelets of the instrument, which they followed upon its withdrawal. A circumstance so interesting and important was calculated to arrest the attention of surgeons, and we accordingly find that they have taken full advantage of it. It was in this way that the late Mr. George Bell, of Edinburgh, had the good fortune to rid a patient of one hundred and fifty concretions. In per-

forming such an operation, a full-sized catheter, with two large eyelets, should be selected, and the bladder should be previously distended with water, so that, as the fluid runs off, the calculi may have a better chance of being forced into the tube.

Instruments have been constructed for the special purpose of seizing the stone, and removing it entire. Sanctorius, if not the first, was one of the earliest surgeons who busied themselves in this manner. He has described the operation with some minuteness, and has figured a pair of forceps which he contrived for performing it. Hales, Hunter and others also invented instruments which have been greatly improved in modern times by Sir Astley Cooper, and some of the French lithotomists. The forceps of the English surgeon, which are represented in fig. 452, and with which he extracted upwards of eighty small calculi

Fig. 452.



from one individual, consist of two movable blades, shaped, when closed, like a curved catheter. They are introduced in the ordinary manner, and are used at first as a searcher. When the stone is found, the blades are gently separated and expanded over it, when, being again shut, the instrument is carefully withdrawn. An index upon the surface of the instrument serves to show the size of the calculus, or, what is the same thing, the possibility of removing it entire. When the concretion cannot be extracted in this manner, it may, if not too hard or large, be crushed, and disposed of piecemeal.

In performing this operation, it is important that the bladder should be perfectly free from irritation, that the urethra be previously dilated by the catheter or bougie, and that the forceps do not pinch the mucous membrane. If these precautions are neglected, serious mischief may follow. At least one instance is on record where death ensued, although the operation was performed by a competent surgeon, and the forceps were introduced only twice.

A small calculus has sometimes been entrapped and removed by a very simple procedure. Many years ago, an American practitioner, Dr. Calvin Conant, relieved a youth, aged fifteen, by means of a silver wire, passed through a catheter, the vesical extremity of which was pierced by two holes, about a line and a half apart. The wire, which was very fine, elastic, and twenty inches long, was formed, upon its arrival in the bladder, into a loop, which was then moved about until the concretion was found and ensnared; the ends were next secured to the shoulders of the catheter, when both the instrument and stone were withdrawn.

### 3. LITHOTRIPSY.

It is not my intention in this place to enter into the history of lithotripsy, or an account of the different steps by which, from humble and



unsatisfactory beginnings, the operation has attained its present extraordinary degree of perfection. To Civiale is, undoubtedly, due the credit of the invention, which threatened, at one time, to supersede lithotomy, and struck terror into the minds of the knivesmen. His first successful operation was performed in 1824, at two sittings.

The procedure, as originally executed by Civiale and others, was denominated lithotrity, as it consisted in seizing, boring, perforating, or piercing the calculus. This name is still retained by him, and likewise by some of the English surgeons, although the operation has been essentially modified. As performed at the present day, at least by most practitioners, it consists in breaking, crushing, or grinding the foreign body, and is, therefore, more appropriately termed lithotripsy.

The *instrument* employed by Civiale, in his earlier operations, was a silver canula, containing a steel tube, furnished with three branches, claws or pincers. Within the steel tube, again, was a cylindrical rod, called the perforator, one end of which was fashioned into a sort of crown with sharp teeth, to bore and break the stone into fragments. The perforator was moved during the operation by a steel drill bow.

Although great improvements have been effected in this instrument, there are comparatively few surgeons who do not now altogether prefer the operation of lithotripsy, not only because it is equally efficient, but because it is much more simple and easy of execution. The merit of the discovery of this operation is usually, at least in this country, ascribed to Baron Heurteloup, of Paris; but there is no doubt that much credit is also due to Mr. Weiss, the celebrated London cutler. As early as 1824, this gentleman contrived an instrument for this purpose; which, after having been variously modified by different lithotriptists, among others by Heurteloup himself, was subsequently remodelled and greatly improved by the inventor. The instrument, as now constructed, is remarkable for its simplicity, its strength, and its adaptation to the end proposed. It

Fig. 453.

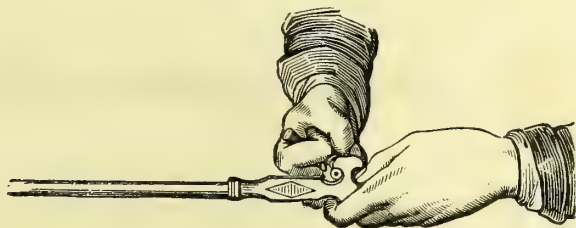


is composed of two blades (fig. 453), curved at the extremity at an angle of about 55 degrees, twelve inches in length, and about the size

Fig. 454.

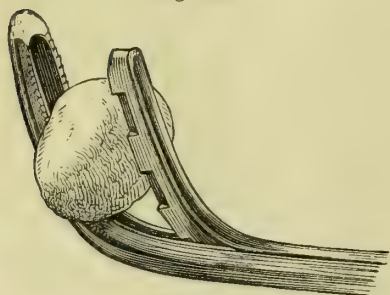


Fig. 455.



of an ordinary catheter; the one sliding within the other, and propelled by means of a screw. Near the upper end of the male rod is a graduated scale, intended to indicate the size of the stone. The extremities

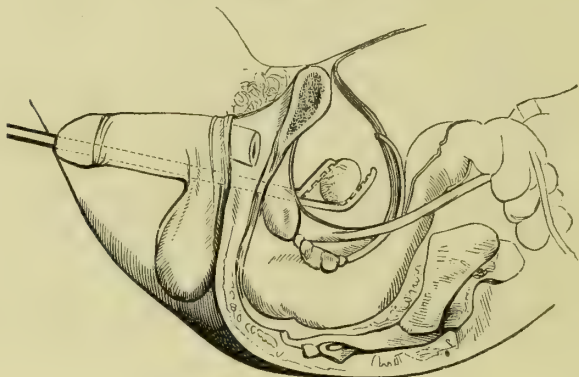
Fig. 456.



of the beak, on their inside, are serrated or notched, the better to seize, retain, and crush the concretion. The curved portion of the fixed blade is hollow, to prevent impaction of the fragments. Fig. 454 represents the screw, or handle, by turning which, in the manner indicated in the drawing (fig. 455), the male blade is propelled onwards, by short and sudden, but

gentle, jerks, so as to imitate slight percussions, until the concretion is shattered. Fig. 456 exhibits the calculus in the jaws of the instru-

Fig. 457.



ment, and fig. 457 the instrument in the bladder, the stone being grasped in a position suitable for crushing.

Every operator should be provided with a number of these instruments, of different forms and sizes, that he may be able, without difficulty, to adapt them to the varying circumstances of his patients. When the concretion is small, or uncommonly soft, the lithotrite sketched at fig. 458, will generally be found to answer every purpose,

Fig. 458.



as it is of simple construction, very light, and of easy management. For the removal of little fragments, or diminutive calculi, an instrument with a short, broad, and rather abrupt curve, the female blade of

which is moulded into a kind of cup, to receive and retain the detritus, may advantageously be used.

In the ordinary lithotrite, the female blade has a large fissure, to allow the fragments, in the act of crushing, to fall away into the bladder, and thus enable the operator to withdraw the instrument without the risk of lacerating the lining membrane of the urethra. These features are well seen in the accompanying cuts (figs. 459 and 460).

Fig. 459.

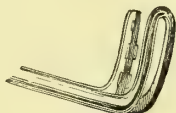
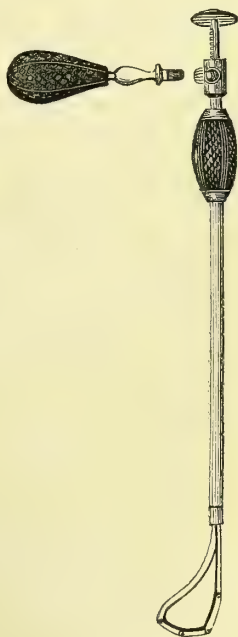


Fig. 460.



Another instrument, the merits of which are certainly equal, if not superior, to those of the one just described, is that of Dr. Jacobson, of Copenhagen. It consists of a silver canula, almost ten inches long, by three lines in diameter, the upper extremity of which is furnished with a circular steel rim, an inch in width, while the lower is slightly curved for about two inches, and terminates in a blunt point. Within this tube is a steel rod, designed to move backwards and forwards at pleasure, and connected inferiorly, with the one just described, by means of an articulated chain consisting of three links. The superior extremity projects beyond the horizontal rim of the canula, and is furnished with a stout screw, which is intended to work the chain backwards and forwards, during the seizure and comminution of the stone. A graduated scale exists upon the instrument for measuring the volume of the stone. Fig. 461 represents Jacobson's crusher as modified by Velpeau.

Fig. 461.



A proper *selection* of cases is a matter of great importance in this operation, for it is not every calculus that admits of being crushed. The circumstances which are favorable to the operation are chiefly a sound condition of the genito-urinary organs, the existence of a small and comparatively soft calculus, and a good state of the general health. There must be no stricture of the urethra, enlargement of the prostate gland, or disease of the bladder, ureters, or kidneys. Even an excess of morbid sensibility of the urinary passages is incompatible with the operation. The stone should be small, soft, and loose. A large concretion cannot be easily grasped and retained by the instrument; a very hard one would be crushed with difficulty; and an adherent or encysted one could not be seized. The mulberry calculus is generally so firm



and dense as to resist any amount of pressure that may be safely employed against it; and the uric acid concretion is frequently so large as to render it impossible to seize it. The operation is also inadmissible when there are a number of calculi.

Before operating, the system and the parts more immediately concerned should be subjected to a course of *preliminary treatment*. If the general health is good, and the bladder is laboring merely under the mechanical inconvenience produced by the stone, little, if anything, will be required beyond a few doses of aperient medicine, rest in the recumbent posture for five or six days, light diet, and the free use of diluent drinks. Should the reverse be the case, a more thorough preparation must be instituted. Under such circumstances, in addition to the ordinary means adverted to, it may be necessary to take blood from the arm, or by leeches from the perineum and the hypogastric region, especially if the patient is young and robust, and to employ the warm bath, bicarbonate of soda with hop and uva ursi tea, and anodynes by the rectum.

The next step is to dilate the urethra. This usually requires but a few days, and is best accomplished with a series of silver catheters, used two or three times in the twenty-four hours.

Chloroform ought generally to be avoided, except in the case of children, as this operation is unattended with much pain. The patient's mind should be clear, in order that he may promptly inform the surgeon of his suffering, should any arise.

During the operation, the patient may lie on his back, near the edge of the bed, or he may sit in an easy chair with a movable back, as may be most convenient. If the patient is recumbent, the head and shoulders should be moderately elevated, the breech should be raised by a pillow, and the thighs should be separated and held up by assistants. The bladder should contain from six to eight ounces of urine, or a suitable quantity of tepid water should be gently injected through a silver catheter. The lithotripter, warmed and well oiled, is now carried into the bladder, in the same manner as a common catheter. Upon reaching the organ, if the stone is not felt, it is to be searched for. The instrument is next planted against the inferior wall of the bladder, the sliding blade is carefully retracted, and then, by a wriggling movement of the wrist, or a sort of sleight of hand, the concretion is engaged in the jaws of the forceps, which are at once closed upon it. Satisfying himself that the lithotripter does not embrace the mucous membrane, as he may by moving its point from side to side, or turning it round, he holds it as firmly and steadily as possible with his left hand, while with the other he propels the screw at the handle of the instrument, thus slowly crushing the calculus. If the concretion is small and friable, one effort of this kind will probably be sufficient; but in general, several will be necessary before this object is fully attained; for even if the foreign body has been pretty thoroughly broken in the first instance, there are almost always some coarse fragments, which require separate seizure and grinding before they can be expelled.

The stone being broken, and a portion of it, if possible, comminuted,

the instrument is closed and withdrawn, care being taken that no large fragments remain impacted in its jaws, lest serious injury be thereby inflicted upon the urinary passages. The patient should now be desired to void his urine, to afford an opportunity to the smaller fragments to escape, the passage of any that remain behind being favored immediately after by injecting the bladder freely and repeatedly with tepid water, through a short, large eyed catheter. The operation, however, should be performed with all possible gentleness, and should be desisted from the moment it becomes a source of much uneasiness or pain. The patient is now put to bed, and kept upon light diet, using, however, large quantities of diluent drinks, such as gum Arabic water, or linseed tea.

If much pain or spasm ensue, with a frequent desire to empty the bladder, a large anodyne is given by the mouth or rectum, and recourse is had to the warm bath, with medicated fomentations to the abdomen and perineum. Retention of urine is relieved with the catheter. If peritonitis threaten, the antiphlogistic treatment must be carried to its fullest extent, aided by the liberal use of opium.

If no untoward symptoms arise, the operation may be repeated in five or six days. To make sure that the bladder is thoroughly free of foreign matter, frequent recourse must be had to the sound, for the smallest remaining particle will certainly become the nucleus of a new concretion.

The length of each sitting should generally not exceed six, eight, or ten minutes; when the operation is productive of pain, it should be much shorter. It is a safe rule to be governed by the feelings of the patient.

The *ill effects* of this operation are—1. Hemorrhage. 2. Rigors and fever. 3. Retention of urine. 4. Contusion and laceration of the prostate and urethra. 5. Cystitis. 6. Perforation of the bladder. 7. Impaction of the fragments of the stone in the urethra. 8. Peritonitis. 9. Purulent infection. 10. Bending and fracture of the lithotriptor. Some of these accidents are unimportant, others serious, if not fatal. Hemorrhage, rigors, retention of urine, and cystitis, should be treated upon general principles.

*Perforation* of the bladder is uncommon, but has sometimes happened in the hands of the most skilful operators. The accident, which is a most serious one, may be caused either by the instrument itself, or by a fragment of the calculus, a sharp corner of which may perhaps be pressed into the coats of the bladder as the lithotriptor is withdrawn. However induced, the lesion is generally rapidly followed by infiltration of urine, and death.

A *fragment* of the broken calculus may be arrested in the urethra, and if sharp and angular, serious mischief may ensue. If it is situated far back, an attempt should be made to push it into the bladder; but if it has advanced considerably forward, it may be removed with the forceps.

*Purulent infection* occasionally occurs, chiefly in old, enfeebled subjects. It is usually very stealthy in its character, and is nearly always fatal. Our principal reliance must be upon mercury and opium, with

tonics and stimulants, and free incisions to give vent to effused and pent-up fluids.

Fracture of the lithotripter has occurred, but for such an accident both the surgeon and his cutler should be held personally responsible.

*Comparative Value.*—It is impossible, in the existing state of the science, to form anything like a correct estimate of the comparative value of lithotripsy and lithotomy. Excepting in France, crushing is so rarely performed that no means for instituting such an estimate have yet been furnished, and in that country the only elaborate data are those supplied by Civiale. From these, it appears that relapse followed in 55 cases out of 548, being in the proportion of nearly 1 to 10. This is unquestionably much greater than in lithotomy, and affords a strong argument against the general introduction of the operation, even in the most favorable cases.

The cause of the frequent relapse after lithotripsy is no doubt the fact that fragments of the broken stone are more liable to be left in the bladder, which thus become, often in a very short time, the nuclei of new formations. In lithotomy, on the contrary, the concretion is generally removed whole, while any pieces that may be split off are either extracted at the time, or they are washed away subsequently by the urine as it flows through the wound, the patency of which, for a certain time, greatly favors this mode of clearance.

#### 4. LITHOTOMY.

Lithotomy may be performed at any period of life, even in early infancy. Experience, however, has shown that the greatest number of recoveries take place in children, and in subjects under thirty years of age. Persons after this time of life are more prone to suffer from inflammation of the urinary apparatus, and perhaps, also, from erysipelas of the wound, and phlebitis of the neck of the bladder and prostate gland.

When a patient is about to undergo lithotomy, he should be subjected to a certain degree of preparatory treatment, in order to place him in the best possible condition to bear the shock and other ill effects of the operation. There is no doubt that much of our success depends upon the manner in which this is done. When the patient is in good health, he will seldom require anything more than a dose or two of aperient medicine, and abstinence from animal food, with rest in his room. Four or five days will, in fact, generally suffice to put him in a proper condition for the operation. But it is very different when he is in bad health; for then a more thorough course of preparatory measures is necessary. The secretions must be rectified, the bowels must be opened by mercurial and other cathartics, the diet must be regulated, and, in a word, all sources of excitement, local and constitutional, must be removed. Too much preparation, however, should be avoided. All serious lesions of the lungs, kidneys, ureters, bladder, and prostate, or, in short, of any other of the more important viscera, forbid interference.

*Lateral Operation.*—Of the different operations for stone, the lateral,



perineal, or infra-pubic, as it has been variously termed, is by far the most important, not only on account of its greater frequency, but also on account of the remarkable success which has hitherto attended it. In the description which I am about to give, I shall speak of it as I am myself in the habit of executing it, premising that this does not differ, in any essential particular, from the method devised and so happily practised by Cheselden and his disciples.

The design of the lateral operation is to make an opening on the left side of the perineum, extending from the surface of the skin through the neck of the bladder and the prostate gland, and large enough to admit of the easy extraction of the foreign body. It is usually described as consisting of three steps or stages. In the first, the surgeon divides the skin, the cellulo-adipose tissue, and the superficial fascia; in the second, the transverse muscle, the triangular ligament, and the membranous portion of the urethra; and in the third and last, the prostate gland and the neck of the bladder.

The wound made in the operation may be said to represent a truncated cone, the apex of which corresponds with the neck of the bladder, and the base with the surface of the perineum. In the adult, its extent externally varies from three inches to three inches and a half, while internally it does not, as a general rule, exceed fifteen or eighteen lines. Its superior angle is an inch and a quarter above the verge of the anus, and immediately on the left side of the raphé of the perineum; the inferior, on the contrary, is usually about three-quarters of an inch to an inch below the anus, and a little nearer to the tuberosity of the ischium than to the outlet in question. The inner wall of the wound corresponds with the middle line of the perineum; the external with the ramus of the ischium and the erector muscle of the penis.

The evening before the operation, a brisk purgative is administered, to clear out the alimentary canal. The article which I usually select for this purpose is castor oil; but if there be disorder of the secretions, as indicated by the state of the tongue and stomach, a combination of calomel and rhubarb, with a few grains of jalap, is to be preferred. If it appears probable that the rectum has not been thoroughly evacuated, a stimulating enema, consisting of tepid salt water, is used a few hours before the operation.

I consider it of paramount importance, both as it respects the safety of the lower bowel, and the comfort of the surgeon, that this precept should be faithfully attended to in all cases. Moreover, by opening the bowels freely, immediately before the operation, there will be no necessity, as a general rule, for any purgative medicine for some days after.

The patient is requested to retain his urine for several hours before the operation, for a certain degree of distention of the bladder is necessary to prevent injury of its walls, and facilitate the extraction of the foreign body. If he be a child, and cannot hold his water without great difficulty, a piece of tape should be tied loosely around the penis, otherwise he will be sure to disobey an injunction which every lithotomist must regard as of no little consequence. In old subjects, affected

with excessive irritability of the bladder, and with a constant desire to micturate, it is necessary to inject the organ with a few ounces of tepid water just before commencing the operation.

During the operation the patient lies upon his back, on a narrow breakfast table, about four feet in length, and provided with stout, firm legs, to prevent it from shaking. It is covered with a folded blanket, over which are spread, first, a piece of soft oil cloth, and next, a folded sheet. Several pillows are required for the head and shoulders, which, however, should be but slightly raised, otherwise the abdomen will be doubled up, and thus unduly compress the bladder. The breech is fully exposed to the operator, and is, therefore, brought low down, a little over the edge of the table. His head and trunk are held by assistants, one of whom administers chloroform.

If an anæsthetic be used, there will be no necessity for tying the

Fig. 462.



hands and feet; otherwise they should be secured by two stout worsted bands, from six to eight feet in length by two inches and a half in width, with a hole in the middle to afford greater security against their slipping; or they may be arranged as in fig. 462. As a preliminary step, the patient, stripped to his shirt, and placed upon the table, is desired to grasp his feet in such a manner as to apply his fingers to the sole and the thumb to the instep; in which position they are confined by means of the fillets, passed round them in the form of the figure 8, the ends being tied in a double knot, or fastened with stout pins. This duty is generally confided to the assistants, for which reason it is often discharged so badly as to be followed by much delay and annoyance; the patient, perhaps, becoming untied during the operation. A careful supervision should, therefore, always be exercised in this respect by the surgeon.

The limbs, bound as here directed, are given in charge of two assistants, who, one standing on each side of the patient, place one hand upon the top of the knee, and the other beneath the sole of the foot. When the operation is about to be commenced, the thighs are moderately separated from each other, and held nearly at a right angle with the trunk. It can easily be perceived how important it must be, in reference to the speedy and successful execution of the operation, that the patient's limbs should be thoroughly controlled, and out of the surgeon's way. It is usually recommended that the staff be introduced previously to the ligation of the patient; but to such a procedure I am altogether averse, because it is productive of serious annoyance to the patient, and is almost sure to be followed by a premature escape of the urine. Besides, it is a source of inconvenience to the persons who have charge of the limbs. My rule, therefore, always is to tie the patient first, and immediately after to introduce the staff; taking care to confide it to a good, intelligent assistant, one who is thoroughly acquainted with the anatomy of the pelvis, and the different steps of the operation. A poor staff-holder is a great curse; for he often excessively embar-

rasses the surgeon, and makes him commit blunders which he might otherwise avoid. During the operation, the instrument is to be held perpendicularly, with the handle nearly at a right angle with the trunk, and inclined *slightly* towards the right side. The curved portion, securely lodged in the bladder, is hooked up closely against the pubic symphysis. The object of this advice is to prevent the instrument from pressing upon the rectum, which would thus be in danger of being wounded. By inclining the handle of the staff a little towards the right groin, the curved portion is made to bear against the left side of the perineum, with the effect of rendering it somewhat prominent and thereby facilitating the division of the membranous portion of the urethra. The assistant having charge of the instrument, stands on the left side of the patient, in order that he may use his right hand, and also hold the scrotum out of the way.

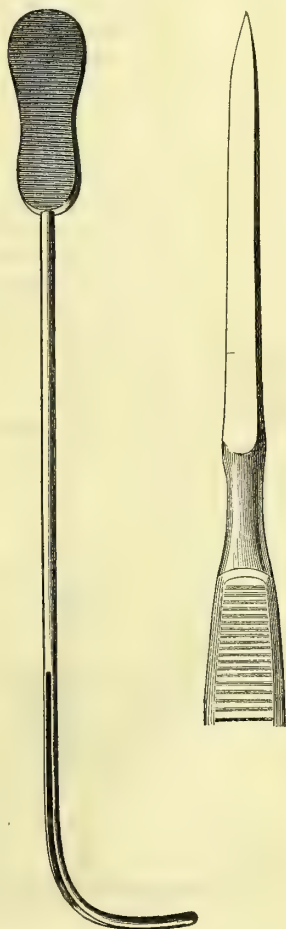
The staff, which I am in the habit of using, is represented in fig. 463. It is shaped like an ordinary silver catheter, and is about ten inches in length, exclusive of the handle, which should be at least two inches long, by two lines and a half in thickness, and fifteen lines in width, and perfectly rough on the surface, that it may be the more securely held in the hand. The groove, placed a little towards the left side, and extending from near the middle of the instrument, to within a short distance of its beak, should be perfectly smooth, and as deep and as wide as possible. The instrument, which is warmed and oiled previously to its introduction, should be large enough to distend the urethra to as great a degree as is compatible with the patient's comfort. By adopting this advice, it will be comparatively easy to find the staff, and to effect, in a safe and proper manner, the division of the neck of the bladder and the prostate gland.

The surgeon, during the operation, sits upon a low, firm chair, or stool, as he may find it most convenient; or he may place himself, as I usually do, in the half-kneeling posture, resting upon the right knee. I generally prefer this posture, because it affords greater freedom to my hands and elbows. A piece of old carpet, or a sheet, is laid upon the floor, under the patient's breech, to receive the fluids.

The knife which I have, for many years, been in the habit of using is the one sketched in the adjoining cut (fig. 464); it is of simple construction, very light and

Fig. 463.

Fig. 464.





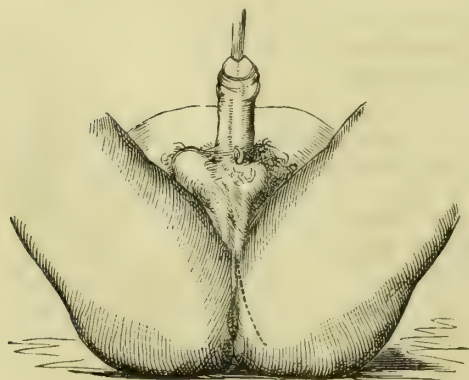
slender, sharp pointed, and nearly seven inches in length, of which three are occupied by the blade, which hardly exceeds two lines in width. With this instrument, the lateral operation may be safely and expeditiously executed in all its stages. For enlarging the opening in the prostate and neck of the bladder, after the withdrawal of the staff, I sometimes use the probe-pointed bistoury, delineated in (fig. 465), though the sharp-pointed is quite as safe, provided the extremity be carefully guided along the index-finger as it lies in the bottom of the wound.

Fig. 465.



Everything being thus prepared—the bowel cleared out, the instruments arranged on the tray, the limbs tied and held out of the way, the staff in the bladder and in the hand of the assistant, the breech projecting over the table, and the patient fully under the influence of chloroform—the operator is ready to begin. Introducing the index-finger, well oiled, into the rectum, to induce it to contract, and ascertain the position of the staff, and marking with his eye the situation of the tuberosity of the ischium, he stretches the integuments of the perineum with the thumb and finger of the left hand, and commences his incisions. The knife is entered just by the side of the raphé, on the left half of the perineum, an inch and a quarter above the margin of the anus, and is carried obliquely downwards and outwards, a short distance below the tuberosity of the ischium, and a little nearer to this point than to the anus (fig. 466). If the part is unusually full, the instrument is plunged in at the first stroke to the depth of at least one inch; otherwise, it must be used more cautiously. As the knife descends, it is gradually withdrawn from its deep position, so as to give the wound a sloping appearance. The length of the incision must be regulated by the size of the perineum and the age of the patient; but, in the adult, it should not, in general, be less than three to three inches

Fig. 466.



Lateral operation for stone.

and a half. In the young subject it must be proportionately smaller.

Placing the point of the left index-finger in the upper angle of the wound, the knife is re-entered just by the side of it, and is made to divide, by repeated touches with its edge, the deep cellular substance of the perineum, the transverse muscle, and a portion of the triangular ligament, with a few of the fibres of the elevator muscle. The membranous portion of the

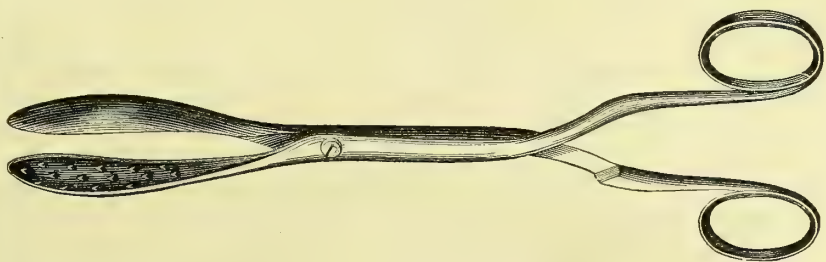
urethra being thus exposed, a little in front of the prostate gland, the surgeon feels for the groove of the staff, at the bottom of the wound, and, having found it, he cuts into it through the denuded tube, the finger-nail serving as a guide to the point of the knife. The length of the opening in the urethra need not exceed the third of an inch.

The knife, inserted into the groove of the staff, through the opening in the urethra, is now carried on into the bladder, dividing, as it passes along, the neck of the organ and the left lobe of the prostate, in a direction obliquely downwards and outwards, which is in that of its long axis. In executing this step of the operation, the rectum is to be held out of the way, by pressing it over towards the right side with the left index-finger, which should be steadily kept in the bottom of the wound, from the moment of the first incision. Great care should also be taken not to prolong the incision in the prostate gland too far back, for fear of penetrating the reflection of the pelvic fascia, and the adjacent venous plexus.

As soon as the bladder has been opened, the urine generally escapes in a gush; the knife is now removed, and the finger, lying in the bottom of the wound, is placed in contact with the staff, which is immediately withdrawn. The urine, as it passes off, frequently forces the calculus down against the artificial opening, so as to afford the surgeon an opportunity of ascertaining its form and bulk. When this does not happen, the finger is carried into the bladder to its full length, and used as a searcher. If the stone is found to be disproportionately large, the wound must immediately be dilated, either with the finger or the bistoury, according as the resistance may seem to depend upon the prostate or the muscular structures. In elderly subjects, the instrument will generally be necessary, as the gland is not sufficiently lacerable to yield to pressure.

The incisions being completed, the next step of the operation is to extract the calculus. This is to be done with the forceps (fig. 467),

Fig. 467.



which are conveyed into the bladder along the upper surface of the index-finger, lying in the bottom of the wound, in contact with the foreign body. The forceps are introduced with the blades closed, and are used at first as a searcher. As soon as they are brought in contact with the concretion, the blades are expanded over it, in the direction of its long axis, and with a firm grasp, to prevent the risk of slipping. Taking care that the instrument does not embrace any of

the folds of the mucous membrane, the operator endeavors to extract the foreign substance by gently moving the forceps from side to side, or upwards and downwards, on the same principle as in the delivery of the child's head. The facility with which the stone may be seized depends upon circumstances. In general, it lies in contact with the inner extremity of the wound, and may readily be caught in the embrace of the blades of the instrument. Sometimes, however, as when it is lodged in the bas-fond of the organ, it refuses to come down, and may thus embarrass the young operator. The difficulty, as will be particularly mentioned hereafter, is easily remedied by inserting the finger into the rectum, and pushing the concretion forwards against the forceps. When the stone is situated in the superior fundus of the bladder, the forceps must be carried high up, in the direction of the long axis of the pelvis, where they are to be moved about as a searcher. Occasionally it lies behind the pubic symphysis, and cannot be seized until it has been dislodged by pressure upon the inferior part of the hypogastric region, aided by the finger in the bladder.

If the calculus is very small, it is sometimes more easily extracted with the scoop (fig. 468) than with the forceps. The same instrument

Fig. 468.



should be used when the concretion has been broken, whether accidentally or designedly, into fragments, which must then be removed piecemeal. The scoop is about ten inches in length, and is shaped, as its name indicates, at each extremity, like a spoon. An instrument like this may be made very serviceable in extracting an adherent, encysted, or impacted concretion.

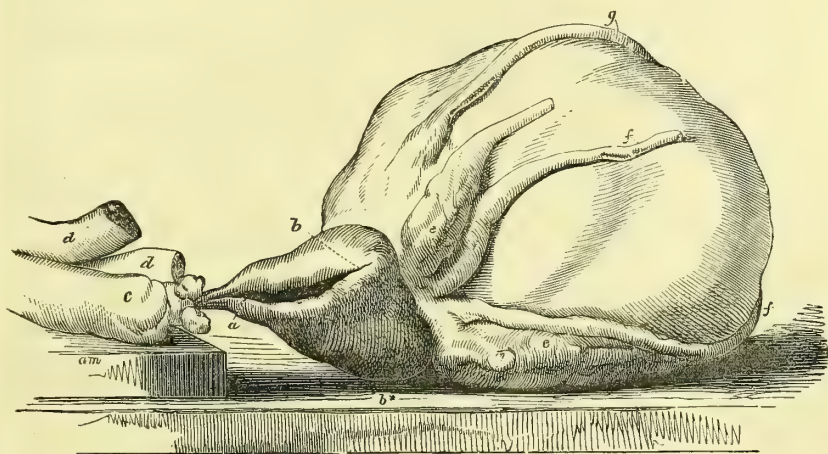
As soon as the foreign body has been extracted, the bladder is washed out with tepid water, thrown up in a full stream from a large syringe. Any pieces or fragments that may have escaped the forceps or scoop are thus removed; otherwise, there will almost certainly be a return of the calculous affection, the smallest particle frequently serving as a nucleus for a new concretion. The bladder having been washed out, a female sound is next introduced through the wound into the interior of the viscus, with a view of ascertaining whether any stones or fragments have been left behind. Should this be the case, the forceps, scoop, and syringe are again used till complete clearance is effected. In general, when the stone is rough, it is an evidence that it is solitary; but to this rule there are occasional exceptions. The operation being finished, the patient is unbound, and conveyed to his bed, a piece of oil-cloth and a folded sheet being placed under his breech, to protect the clothing and absorb the urine.

*Extent of the Incision of the Prostate.*—The wound should in no instance, however bulky the stone may be, extend entirely through the lateral lobe of the prostate, on account of the danger of urinary infiltration. When the concretion is very voluminous, it should either be



broken, and extracted piecemeal, or, what is better, the opening should be enlarged by incising the opposite half of the gland. If this do not afford sufficient room, the calculus should be crushed. In ordinary cases, I incise the organ only to a very limited extent, and immediately after enlarge the opening with the finger, the pressure of which is generally amply sufficient for the purpose. When it is not, the probe-pointed bistoury is used as a substitute. In old subjects, in whom there is induration with enlargement of the gland, the division is generally obliged to be effected with the instrument. The outer wound, on the other hand, should always be ample and dependent. The direction and extent of the incision in the prostate gland are represented in the annexed cut (fig. 469), copied from Scarpa.

Fig. 469.



Left lobe of the prostate, as it is divided in the lateral operation. *a*. Marks the incision of the membranous portion of the urethra and the side of the gland. *b*. The left lobe of the prostate. *b\**. The right lobe of the organ. *c*. The bulb of the urethra. Close behind are observed Cowper's glands. *d, d*. The legs of the penis. *e, e*. The seminal vesicles. *f, f*. The deferent ducts. *g*. The ureter of the left side.

*Difficulties of Extraction.*—Difficulty frequently occurs in the extraction of the stone. This may depend, 1st, upon the stone itself; 2d, upon the bladder; and 3d, upon the pelvis.

1st. The difficulty may be caused by the lodgment of the stone in the bas-fond of the bladder, which is sometimes converted into a sort of cul-de-sac. The remedy is to raise the stone up, and place it within reach of the instrument, by the left index-finger, inserted in the rectum. When the stone is lodged above the pubes, it is to be displaced by compressing the hypogastrium, with a strong probe, bent into a hook, or it may be drawn down with the index-finger.

2d. The stone may be entangled in the folds of the mucous membrane; or it may be spasmodically grasped by the bladder, which may thus prevent the blades of the forceps from being expanded over it. In the former case the scoop replaces the forceps, or, if this fail, dis-

lodgment may be attempted by throwing cold water into the bladder, in a full stream, from a large syringe. Anæsthetic agents are the most useful in relieving the spasm.

3d. The stone may be encysted. When this is the case, it is advisable to introduce the finger into the bladder and to rupture the cyst with the nail; or, when this is impracticable, to divide it with a probe-pointed bistoury, or a knife, fashioned like a gum lancet, and furnished with a long handle. Embarrassment may be occasioned by the presence of a pouch between the bladder and the rectum.

4th. It may be difficult to seize the stone on account of the great depth of the perineum.

5th. The stone, under the grasp of the forceps, may break into numerous fragments, be reduced to a soft pulpy mass, or be crushed into small sandy particles. The fragments, according to their size, may be removed with the forceps, scoop, or syringe.

6th. Delay and inconvenience may arise from the presence of a considerable number of calculi.

7th. Embarrassment may proceed from the manner in which the stone is grasped. When there is reason to believe that it has been seized by its long diameter, the finger should at once be introduced into the wound to ascertain the fact, and to effect the necessary change. Before this can be done, however, the forceps must relax their hold upon the calculus, though there will be no need of withdrawing them.

8th. Embarrassment occasionally results from an inability to find the concretion. This may depend upon some of the causes already detailed; or, it may be owing to the expulsion of the stone, especially if it be of small volume, at the moment of completing the section of the bladder and the prostate gland.

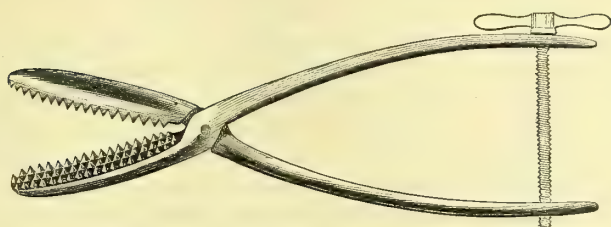
9th. But the greatest embarrassment of all that are encountered in the extraction of the stone, arises from its bulk. When the calculus is of unusual magnitude, the extraction is to be accomplished either by simply enlarging the wound, if this has not already been done, to the utmost permissible limits, or by incising the right lobe of the prostate to the same extent as the left; or, finally, by breaking the concretion, and removing it piecemeal.

Dilatation of the wound is effected with the probe-pointed bistoury, carried downwards and outwards in the direction of the original incision, while the stone is held firmly by the forceps. The right lobe of the prostate is divided in the same manner and in the same direction as the left. These two methods may almost always be resorted to with a reasonable prospect of success, when the weight of the stone does not exceed three or four ounces. When the concretion is very bulky crushing will generally be necessary.

The forceps represented in the annexed cut (fig. 470) are well calculated for the operation of crushing. They are constructed upon the principles of the ice-masher, and do their work most effectually.

11th. Embarrassment of a very serious, if not an insurmountable character, may arise from unusual narrowness of the pelvis.

Fig. 470.



12th. The calculus occasionally co-exists with calcareous incrustation of the surface of the bladder. The proper procedure is, first, to extract the calculus in the usual manner, and then to remove the calcareous matter with the forceps, scoop, and finger, aided with the syringe.

Lastly, calculi of large size, weighing ten, twelve, and even fifteen ounces, have occasionally been successfully extracted. Most generally, however, the patient dies either from exhaustion during the operation, or from the effects of inflammation a short time afterwards.

The *accidents* that are liable to occur during and after the lateral operation, are hemorrhage, prostration, retention of urine, undue inflammation of the wound, injury of the prostate gland, urinary infiltration, peritonitis, tetanus, wound of the rectum, incontinence of urine, impotence, perineal fistule, and explosion of pre-existing disease.

1. *Hemorrhage*.—The hemorrhage after the perineal section is usually very slight, not exceeding two or three ounces. It may be arterial or venous, primitive, or secondary. Its principal sources are the artery of the bulb and the superficial artery of the perineum. In old subjects, a copious flow of blood occasionally proceeds from the veins of the neck of the bladder, and of the prostate gland. The pudic artery, in its natural course, can hardly be wounded posteriorly: anteriorly, however, it is more exposed, and therefore, in danger of being injured. The accident is most likely to happen when the prostate is divided by the gorget, or the lithotome caché. The artery of the bulb sometimes bleeds profusely; and, from its deep position, and the readiness with which it retracts, is always secured with difficulty.

A tremendous gush of blood sometimes proceeds from the transverse perineal artery. The bleeding generally follows the first incision, and should immediately be arrested by the ligature. The superficial perineal artery is seldom cut; when it is, the bleeding is usually insignificant.

When the affected vessel is deep-seated, the blood, instead of escaping externally, may pass into the bladder, where it is either retained, or expelled from time to time in thick clots. The organ, in the latter case, forms a hard, solid tumor, which is more or less tender on pressure, and which may mount as high up as the umbilicus. The expulsion of the clots is attended with violent spasm and tenesmus, bearing a close resemblance to labor pains.

When the bleeding vessel is accessible, the proper means for



arresting the hemorrhage is, of course, the ligature. When it is very deep-seated, it may generally be readily seized with Physick's artery forceps, delineated in the annexed cut (fig. 471), the edges of the wound being separated with retractors, the fingers, or a pair of lithotomy forceps. When the artery is situated very far back, at the neck of the bladder, or by the side of the prostate gland, it may be extremely difficult, if not impossible, to ligate it. To meet this contingency I devised, some years ago, a pair of forceps, which, after having grasped the artery, may be permanently retained, by unscrewing its handle, until all danger from hemorrhage is over. The instrument is represented in the adjoining sketch (fig. 472).

Fig. 471.

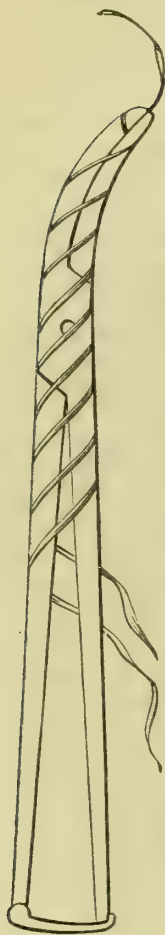
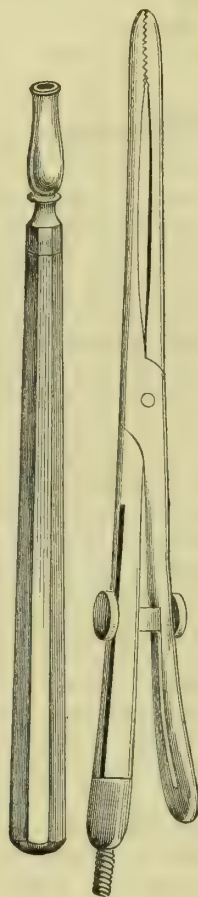


Fig. 472.



*Compression* may be resorted to, when it is impossible to use the ligature or torsion. A canula, consisting of silver, or gum elastic, three inches and a half long, by four lines in diameter, surrounded by charpie, sponge, or cotton, and pierced with two holes at the perineal extremity for securing it, by means of threads to a T-bandage, is introduced into the bladder, thus serving the twofold purpose of conducting off the urine, and compressing the bleeding vessel. It should be retained for several days, or until there is reason to believe that all

danger of hemorrhage is over. When no canula is at hand, a female catheter, a piece of reed, or the spout of a tin coffee pot, may be used as a substitute. Plugging of the wound is particularly necessary when the hemorrhage proceeds from enlarged and varicose veins at the neck of the bladder and prostate gland, or when the blood oozes from a great many small arteries, too minute to be tied. The operation, of course, always interferes with the union of the wound.

*Styptics* are sometimes useful, especially in deep-seated venous hemorrhage, the best articles for the purpose being alum, acetate of lead, and persulphate of iron. The actual cautery can seldom be required.

Occasionally the hemorrhage is promptly arrested by directing a

concentrated stream of cold water from a syringe upon the bleeding spot. Exposure of the wound to the cold air, and keeping it free from clots, is also sometimes highly beneficial.

*Secondary hemorrhage* generally takes place as soon as reaction is established, or the patient has recovered from the shock of the operation. The means already pointed out will usually be sufficient to arrest it.

2. *Sinking*.—Few patients, at the present day, suffer much from shock in the operation of lithotomy. Should this event arise, recourse must be had to stimulants, care being taken during reaction that over-excitement do not occur.

3. *Retention of Urine*.—This may be caused by inordinate tumefaction of the wound, and spasm of the urethra; or, as more frequently happens, by closure of the two passages by coagulated blood. In the former case relief is afforded by the catheter; in the latter, by clearing away the blood, and preventing further hemorrhage.

4. *Undue inflammation of the wound*, if it should take place, usually supervenes within the first forty-eight hours. The action is sometimes erysipelatous, and is then apt to spread.

5. *Phlebitis* occasionally occurs after this operation. It is most frequently met with in elderly subjects. The treatment, although antiphlogistic, is conducted cautiously, and with due regard to the state of the system.

When the phlebitis attacks the extremities, the proper local remedies will be leeches, fomentations, iodine, and blisters, followed by free incisions to afford vent to effused and pent-up fluids. The system must be supported by anodynes and stimulants. Venesection is generally inadmissible, and the use of mercury, except in so far as it tends to correct the secretions, may commonly be dispensed with. After the violence of the inflammation has subsided, the limb should be bandaged, and as soon as the patient can move about, change of air should be advised.

6. *Lesion of the Prostate Gland*.—This gland may be gravely injured in this operation, either by the knife, the finger, the forceps, or the calculus. The most serious mischief is usually inflicted by the forceps. The accident, however, is extremely rare, and ought never to happen in the hands of a skilful lithotomist.

7. *Urinary Infiltration*.—One of the most dangerous effects of lithotomy is an escape of urine into the cellular tissue of the perineum, or of the perineum and the parts immediately around the neck of the bladder. Its occurrence is favored by too free a division of the prostate gland; by the small size of the wound, or by its being too conical or sloping; by the early and inordinate tumefaction of the cut surfaces; and, above all, by the perforation of the reflected portion of the pelvic fascia. The attack usually comes on within a short time after the operation, and often runs its course with frightful rapidity.

Little can be done to arrest the progress of this affection when once established. Depletion by the lancet, and by purgatives, is wholly inadmissible. The system is to be sustained by such remedies as car-

bonate of ammonia, quinine, camphor, and capsicum, in combination with the liberal use of brandy and opium. The best topical means are saturnine and opium fomentations, medicated cataplasms, injections of a weak solution of nitric acid or chloride of soda, and touching the whole track of the wound as early as possible with nitrate of silver, or the tincture of iodine. When the infiltration is caused by the small size, ill shape, or improper direction of the wound, the defect must be remedied by the knife, to afford a free outlet for the urine. Leeches and hot fomentations may be applied to the hypogastric region.

8. *Peritonitis*.—Peritonitis seldom follows the lateral operation, but is occasionally observed as a consequence of the high. The treatment must be prompt and vigorous. Blood should be taken by the lancet, or, when that is inadmissible, by leeches to the hypogastrium, succeeded by anodyne fomentations. The bowels are confined with opium, and the pulse is kept down with aconite and other depressants.

9. *Telanus*.—This sometimes occurs, but very rarely; should an attack be threatened, the proper remedies are anodynes and anti-spasmodics, aided, if the subject be much debilitated, by brandy, wine, or porter. Chloroform is a valuable adjuvant, when there is much suffering, in controlling muscular action.

10. *Wound of the Rectum*.—This accident may happen, but will not be likely to do so if the proper precautions are taken in performing the operation. The opening, which is generally situated immediately in front of the neck of the bladder, soon begins to diminish, and usually closes in a few weeks.

The treatment consists in preventing the bowels from acting, except every third or fourth day, by means of anodynes, in washing out the rectum frequently with cold water, in permitting none but the most bland and simple food, and in enjoining a strict observance of the recumbent posture.

11. *Sloughing of the Rectum*.—This is most liable to take place in weakly, delapidated subjects. The immediate cause of the occurrence is probably slight infiltration of urine, in consequence of the great and unnecessary depth of the wound, or injury done to the rectovesical septum during the extraction of the calculus. No definite rules can be laid down respecting the treatment, which must evidently be regulated by the circumstances of each individual case. In general, it will be necessary to support the strength by a proper diet, and by tonics, especially quinine, wine, and brandy.

12. *Incontinence of Urine*.—Incontinence of urine, consequent upon perineal lithotomy, is happily infrequent. It is not always easy to determine how this accident is produced. Most commonly, however, it arises, from injury inflicted upon the neck of the bladder during the extraction of a large and very rough calculus, but I have known it to occur when the stone was unusually small.

When there is a probability that incontinence of urine will take place, every effort should be made to prevent it. The patient should



be strictly confined to his bed, a warm bath should be administered once a day, for twenty-five or thirty minutes at a time, tepid water should frequently be thrown into the rectum, and free use should be made of demulcent drinks.

When the affection is fully established, it will be necessary to leech the perineum occasionally, and to apply gentle, but steady pressure upon that part with the pad of a T truss. In obstinate cases, cauterization of the neck of the bladder, and the commencement of the urethra may be tried.

13. *Impotence*.—This, like incontinence of urine, is very rare after perineal lithotomy. It does not admit of relief.

14. *Perineal Fistule*.—The wound made in lithotomy generally heals in from three to four weeks; but sometimes it remains open much longer, and occasionally it does not close at all, but degenerates into a fistule, the existence of which is determined by the appearance of the urine at the external opening, and by an examination with a probe.

The treatment consists in retaining a silver catheter constantly in the urethra, and in cauterizing, every sixth or eighth day, the neck of the bladder with nitrate of silver. The patient should be confined to his back, with the nates elevated. When the track is unusually small, and the perineum uncommonly thin, relief may sometimes be afforded by the occasional introduction of a heated probe, wire, or knitting needle. In intractable cases, it may be necessary to incise the parts.

15. *Explosion of Pre-existing Disease*.—Stone, as is well known, frequently co-exists with other diseases, which, whether latent or open, often acquire new intensity on the removal of the vesical irritation. The organs most likely to suffer in this manner are the kidneys, bowels, brain, heart, and lungs.

*After-treatment*.—As soon as the stone has been extracted, the bladder washed out, and the bleeding arrested, the patient is carried to his bed, always properly arranged beforehand. It should be provided with slats, and a cotton, moss, or hair mattress, covered with a sheet, over which is spread a large piece of soft oil cloth. Another sheet, called the draw-sheet, folded several times, and arranged so as to make the middle of it correspond with the buttocks, is placed upon the top of the oil cloth, and serves to ward off pressure, as well as to receive the secretions as they flow from the wound. The head and shoulders should be slightly elevated by a pillow.

My experience has taught me that it matters little, if any, what posture the patient assumes after he has been put to bed. I usually, however, request him to lie on his right side for the first five or six hours, to afford the lips of the wound an opportunity of becoming glazed with lymph before he is obliged to urinate. At the end of this period, and, indeed, often much earlier, I permit him to rest upon his back, or upon either side, as may be most agreeable to him. Young subjects, unless they are incessantly watched, will seldom remain in the same posture beyond a few minutes, and, I must confess,

I have never seen a case in which any detriment resulted from this source.

It is equally unnecessary, in my judgment, to tie the patient's knees together after the operation; or to introduce a tube into the bladder by the wound, for the purpose of conducting off the urine, with a view, as is alleged, of preventing infiltration of the surrounding cellular tissue. The expedient can never be required, except in those cases in which the incisions have been made unusually extensive.

The urine sometimes begins to flow by the wound in a few minutes after the operation; but, in general, very little, if any, passes for the first three or four hours. It then usually comes away in a gush, attended with pain and spasm of the neck of the bladder. By the end of the first day, the edges of the wound are generally so much swollen that the urine ceases to flow through the perineum, and takes the course of the urethra. This, however, rarely continues beyond twenty-four or thirty-six hours, when the tumefaction has usually so far subsided as to allow the fluid to flow in its original direction. The period at which the urine begins to pass off permanently by the urethra varies from ten to fourteen days. The change in the direction of the fluid is generally attended with more or less pain at the neck of the bladder, and a scalding, smarting, or burning sensation in the urethra and the head of the penis.

The treatment after the operation must be strictly antiphlogistic. The patient is kept quietly in the recumbent position, and all excitement, both bodily and mental, is sedulously guarded against. The pain consequent upon the operation is often extremely severe. It generally makes its appearance as soon as the patient wakes up from the effects of the chloroform, and should be promptly met by a full dose of morphia.

Demulcent *drinks* should be used freely throughout the treatment, especially during the first few days. They serve both to allay thirst and to dilute the urine. They may be simple, or combined with nitrate of potassa, bicarbonate of soda, or dilute nitric acid, according to the particular indications of the case.

The *diet* must be light, unirritant, and of the most simple kind. For the first few days the patient should take little else than panada, gruel, chicken broth, or milk and bread. After that he may use a little rice, toast and tea, a few crackers, or a small quantity of mush and milk. No meat or vegetables should be permitted under five or six days, unless he is decidedly weak.

In all cases, I make it a rule to prevent any action of the bowels for the first three days. For this purpose, I invariably give a full anodyne immediately after the operation. At the end of this time, a dose of castor oil or Epsom salts is generally ordered, assisted, if necessary, by an enema.

Every possible attention should be paid to the cleanliness and comfort of the patient. Excoriation should be prevented; and the scrotum must be kept out of the way of the wound by a suspensory bandage.

If the edges of the wound should become covered with the earthy

phosphates, the best remedy is the nitric acid lotion, in the proportion of about four drops to the ounce of water, applied by means of a folded cloth. When the incrustation extends far back, the fluid may be daily injected into the bladder. In most cases the local application should be aided by the internal exhibition of the remedy. When the wound is tardy in healing, or has contracted to a mere orifice, a catheter ought to be permanently retained in the bladder, to conduct off the urine through the natural channel.

The wound made in this operation occasionally unites by the first intention; but such an event, desirable as it certainly is, is rarely to be expected under any circumstances. I do not recollect a solitary instance among my own operations, in which the parts were seriously bruised in the extraction of the calculus, or unduly divided in making my deep incisions; and yet I have never had a case of union by the first intention, properly so called.

*Statistics.*—Of 895 cases of the lateral operation of lithotomy in the practice, chiefly private, of American surgeons, 851 were cured, and 44 died, making a proportion of 1 in  $20\frac{1}{3}$ . In 426 of these the gorget was used, and in 424, the knife, with a mortality for the former of 1 in  $23\frac{7}{9}$ , and for the latter, of 1 in  $19\frac{4}{11}$ .

Of 1,596 cases of the lateral operation in the private and hospital practice of European surgeons, 1,464 were cured, and 132 died, making a proportion of 1 in  $12\frac{1}{11}$ .

Cheselden lost 20 cases out of 213; Martineau, 2 out of 84; Kern, 31 out of 334; Liston, 16 out of 115; Brett, 7 out of 108; Vèricel, 9 out of 109; Chrichton, 14 out of 200; and Dr. Dudley, who has operated exclusively with the gorget, 6 out of 207.

The circumstances which tend to influence the results of the lateral—as, indeed, of every other operation of lithotomy—are exceedingly numerous and diversified in their character, and are worthy of profound consideration. The most important of these circumstances are referable, 1st, to the skill of the surgeon; 2dly, the preparation, age, and health of the patient; 3dly, the nature, volume, and situation of the concretion; and, 4thly, the selection of our cases.

*Relapse.*—When it is considered that most vesical concretions have their origin in the kidneys, or, at all events, that these organs are often cotemporaneously affected, it is not surprising that the disease should occasionally return after operation. What number of cases relapse after being lithotomized, is a point for the determination of which we have no positive data. There is no doubt that it is greatly influenced by the nature of the calculous diathesis, and I think it is safe to affirm that persons affected with phosphatic calculi are more prone to suffer a second, and even a third time, than those affected with lithic concretions, or concretions composed of urate of ammonia. Diseases of the urinary organs, or of the digestive apparatus, may be mentioned as predisposing causes of relapse. Indeed, whatever has a tendency to disorder the general health, will be likely to promote the recurrence of the malady. Injuries of the spine, unless promptly relieved, will almost be sure to be succeeded by relapse.



The period at which relapse occurs must, of course, depend upon circumstances. Occasionally, it is very short; and, on the other hand, a number of months, and even years, may intervene. As a general rule, the phosphatic and ammoniaco-magnesian calculi are more rapidly reproduced than the lithic and oxalic.

*Varieties in the Lateral Operation.*—The operation described in the preceding pages is executed, as has been seen, with the knife, and nothing could possibly be more simple. It is the very perfection of lithotomy. Nevertheless, there are some surgeons who prefer the use of the gorget, the lithotome caché, or the beaked knife.

The operation with the *gorget* does not differ, in its early stages, from that with the knife. The period for using the instrument is immediately after the incision of the membranous portion of the urethra. The surgeon then exchanges the scalpel for the gorget, the

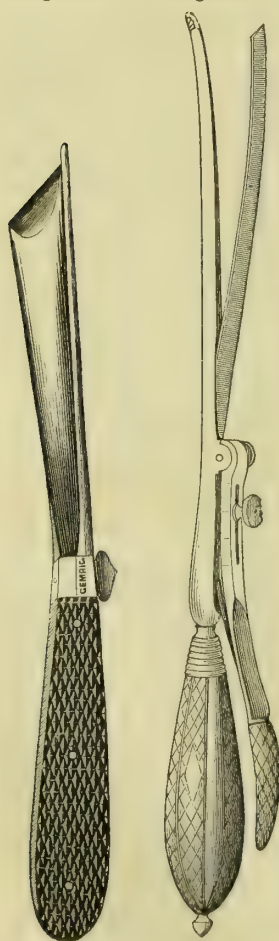
beak of which is placed in the groove of the staff, guided by the point of the left index-finger. After assuring himself, by drawing the instrument slightly backwards and forwards, that it is in no danger of slipping, he takes hold of the handle of the staff, and, by a simultaneous movement of his hands, he lowers the instrument and the gorget nearly to a level with the abdomen; pushing, at the same time, the latter onward into the bladder. In executing this part of the operation, care should be taken not only that the gorget does not slip out of its place, and thus pass between the rectum and the bladder, but that it is properly lateralized, otherwise there will be great risk of injury to the rectum and the pudic artery. The annexed engraving (fig. 473) represents the gorget, as modified and improved by Physick and Gibson.

Instead of the gorget, some lithotomists employ a *beaked knife*, or a probe-pointed bistoury, for dividing the neck of the bladder and the prostate gland. The instrument may be either straight, or somewhat concave on its cutting edge. The one which I generally use, if I use any of the kind at all, is represented at page 878.

The *single lithotome*, invented, I believe, by Frère Côme, is seldom employed at the present day. The annexed cut (fig. 474) represents the instrument, as modified and improved by Charrière. It will be observed that it has a single blade, moved by a spring, and concealed in a kind of a rod, fixed in a

Fig. 473.

Fig. 474.



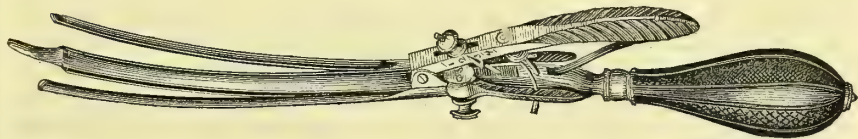
stout handle, and surmounted by a beak, to enable it to slide the more easily and securely in the groove of the staff. The extent to which the blade may be opened is regulated by means of a screw attached to the spring.

The external incisions having been made in the ordinary manner, and the membranous portion of the urethra being fully exposed, the beak of the lithotome is inserted into the groove of the staff, and passed on into the bladder. The blade is then expanded to the requisite degree, and the division of the deep structures effected in withdrawing the instrument, its edge being directed obliquely downwards and outwards, in the long axis of the prostate gland.

*Bilateral Operation.*—The merit of devising this operation is usually ascribed to Celsus, though it more probably belongs to Le Dran. Its advantages have been prominently set forth in modern times by Chaussier, Beclard, and Dupuytren, the latter of whom first performed it in 1824, and who may be said to have regularized and perfected it.

If the bilateral section possess any advantages over the ordinary method, it must be on the ground of its affording a larger opening for the passage of the foreign body, and that it is attended with less danger to the rectum and the seminal ducts. But even of these the former is, in great degree, counterbalanced by the modern method of dividing the right lobe of the prostate, if the wound in the left be found insufficient for the extraction of the calculus. The operation has sometimes been performed instead of the lateral, on account of difficulty occasioned by malposition of the thigh. It requires the same preliminary measures as the other method. The incisions through the perineum, as far as the groove of the staff, are executed with an ordinary scalpel, and the prostate is divided with a double lithotome caché (fig. 475),

Fig. 475.

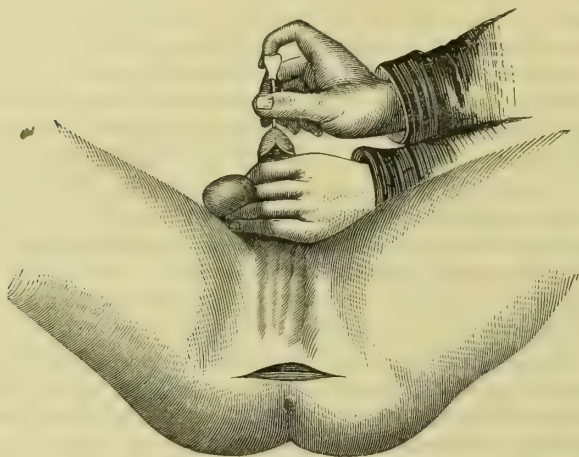


a narrow knife, or a probe-pointed bistoury, according to the fancy of the surgeon.

The operation consists in making a semilunar incision across the perineum, beginning on the right side, midway between the tuberosity of the ischium and the margin of the anus, but a little nearer the former than the latter, and terminating at the corresponding point of the opposite side, as seen in fig. 476. The concavity of the cut is directed downwards, and its centre, situated at the raphé of the perineum, is about nine lines above the anus. In this direction are successively divided the skin, cellulo-adipose tissue, and superficial fascia, together with a few of the anterior fibres of the external sphincter muscle. The end of the left fore-finger is now placed in the bottom of the wound, just as in the ordinary procedure, the staff

sought, and the membranous portion of the urethra laid open, by an incision not exceeding four lines. The nail of the finger is then applied to the staff, to serve as a guide to the lithotome, the beak of which

Fig. 476.



is next inserted into the groove of the instrument, with its concavity upwards. Taking care, by moving the lithotome several times forwards and backwards, that it is securely lodged in the groove, the surgeon seizes the handle of the staff, and depresses it nearly to a level with the abdomen, at the same time that he lowers the lithotome, and pushes it onward into the bladder. As soon as the instrument has reached the viscus it is turned round with its concavity towards the rectum, and while it is in this position it is withdrawn, its blades being expanded by pressing their springs. In this manner it cuts its way out, slowly and steadily, dividing in its retrograde course the sides of the prostate, in a direction obliquely downwards and outwards, as in the ordinary section. The finger now takes the place of the instrument, the situation of the stone is ascertained, the forceps are introduced, and extraction is effected in the usual manner.

No statistics have yet been furnished, on an enlarged and reliable scale, of the results of the bilateral operation. In the posthumous work of Dupuytren, who introduced this method into France, and who imparted to it much of its present perfection, is a table comprising 89 cases, of which 19 terminated fatally, making an average mortality of 1 in  $4\frac{1}{3}$ . It is proper to add that four of these cases occurred in females, who all recovered.

Of 118 cases of this operation by American surgeons, as Mussey, Spencer, Eve, Stevens, Willard Parker, and others, 105 recovered, and 13 died, showing a mortality in the proportion of 1 to  $9\frac{1}{3}$ . If, to these cases, we add those of Dupuytren, we shall have an aggregate of 207 cases, with 32 deaths, or a loss of 1 in  $6\frac{1}{2}$ .

*Median Operation.*—Attention has recently been directed to this



operation by Professor Rizzoli, of Italy, who, at the date of his publication, had performed it eight times, and in every instance successfully. As the name indicates, it consists in opening the bladder at the raphé of the perineum, which, as a preliminary step, is rendered as prominent as possible by means of a curved staff. It is not difficult to conceive that this operation might answer admirably in cases of small calculi, while it might be very objectionable in large ones, on account of the inadequacy of the wound made by it.

*Medio-Lateral Process.*—Professor Buchanan, of Glasgow, proposed, a few years ago, to enter the bladder along the median line by means of a *rectangular staff*, with the groove on the left side, and a straight, narrow knife, with a long edge, shaped at the point like a scalpel, but fitted to stab as well as to cut. The staff being introduced into the bladder, is moved backwards and forwards, over the left index-finger in the rectum, until the prominent angle is distinctly perceived in the perineum, at the anterior verge of the anus, or at that portion of the raphé where the skin and mucous membrane are insensibly blended with each other. The instrument is now confided to an assistant, with a request to maintain it firmly in its position, with the handle inclined towards the abdomen. The surgeon, holding the knife horizontally with the edge turned towards the left side, penetrates the skin and other tissues of the perineum until the point is partly in the groove of the staff, when he conducts it directly onward until it reaches the bladder, a circumstance which is always indicated by the escape of a few drops of urine. Withdrawing the knife from this position, he now carries it obliquely downwards and outwards, for three-quarters of an inch, in the direction of the forepart of the tuberosity of the ischium, and then finishes by cutting, for three-eighths of an inch, almost vertically downwards. If the wound is not sufficiently large to admit of the easy extraction of the calculus, it may afterwards be enlarged to any desired extent.

The advantages which Dr. Buchanan claims for this operation are, 1st, that it is more easily and rapidly executed than the ordinary lateral one; 2d, that it is less severe, because of the less extensive division of the parts; and, 3d, that it is not attended with so much risk of hemorrhage, of injury to the rectum, and of urinary infiltration. It appears from recent statistics that, of 52 operations for stone, performed according to this method, by Dr. Buchanan and Dr. Lawrie, in the Glasgow Infirmary, 47 recovered, and 5 died, thus showing a mortality in the proportion of 1 to 10.4.

*Lithectasy.*—Perineal lithotomy is occasionally combined with dilatation, a process constituting what may be denominated *lithectasy*, the object being to make a small opening in the first instance, which may afterwards, if necessary, be increased by pressure. The operation was originally suggested by Manzoni, of Verona, early in the present century, and has recently been warmly advocated by Dr. de Borsa, who seems to prefer it to every other expedient, on the ground of its freedom from hemorrhage and urinary infiltration, as well as the rapidity with which it may be executed, a single minute usually sufficing for

its completion. The only instruments required are a staff, a bistoury, and a pair of forceps. Having made an incision through the raphé of the perineum, de Borsa opens the whole of the membranous portion of the urethra, so as to expose the staff to the extent of about ten lines; when, laying aside his knife, he at once passes the left index-finger into the bladder, along the right side of the instrument, and then, by a semi-rotatory movement of the member, gently and cautiously conducted, he dilates the prostatic portion of the tube and the neck of the bladder sufficiently to enable him to introduce the forceps and extract the calculus. The operation is, of course, applicable only to small calculi.

A modification of this operation has, within the last few years, been practised by Mr. Allarton, of Sydenham, England. It consists in making an incision, with a long, straight bistoury, directly through the raphé of the perineum, about six lines above the verge of the anus, down upon a curved staff with a central groove, the instrument being previously hooked against the pubic symphysis, and well steadied by the left index-finger in the rectum. The knife, after having reached the staff, is carried a little towards the bladder, but not into it, when it is withdrawn, enlarging, as it retraces its steps, the external opening towards the scrotum, so as to make it altogether from an inch to an inch and a half in length. The operator then, inserting into the bladder a probe surmounted with a bulb, removes the staff, and expands the wound with the forefinger of the right hand. If the stone be small, it will now probably fall into the wound, and be forced down by the patient as he strains. Should this fail, the finger is again used, its size being increased by the addition of an India-rubber stall, until the dilatation has been carried to the required extent. If the calculus be rather large, it may be crushed.

*Recto-Vesical Operation.*—The recto-vesical operation, devised in 1816, by Sanson, of Paris, is already obsolete. It consists, as the name implies, in cutting into the bladder through the rectum, perineum, and prostate gland. It has been abandoned on account, chiefly, of its liability to be followed by extensive suppuration of the cellular tissue within the pelvis, injury of the ejaculatory ducts and seminal vesicles, and, lastly, though not least, stercoraceous fistule, difficult, if not impossible, of cure.

*Supra-Pubic Operation.*—In the supra-pubic, hypogastric, or high operation, the bladder is opened above the pubes, in the direction of the linea alba. Its chief advantages are, that it is free from hemorrhage; that it does not expose the patient to injury of the rectum and the ejaculatory ducts; that there is no risk from inflammation of the neck of the bladder; that it may be performed where the lateral section is impracticable; and, lastly, that it admits of the more easy removal of a large, attached, or encysted calculus. As an offset to these advantages, it is to be remarked that the procedure is liable to be followed by injury of the peritoneum, and by urinary infiltration, not to say anything of the difficulty of executing it when the abdomen is loaded with fat, or the bladder does not ascend any distance above the pubes.

The latter of these dangers may, however, in general, be avoided by premising a perineal puncture, to serve as an outlet to the urine, which thus drains off as fast as it reaches the neck of the bladder. The former, too, may usually be guarded against, if the precaution be used, first, to distend the bladder thoroughly before the operation, and, secondly, to push the peritoneum gently before the knife, after cutting through the inferior part of the linea alba.

In performing the operation, the patient is placed recumbent, upon a narrow table, with the legs hanging loosely over its lower edge, and the feet resting upon a high chair. The head and shoulders are somewhat elevated, to relax the abdominal muscles. The bladder, if not previously distended by its own contents, is now filled with tepid water until it rises a considerable distance above the pubes. The surgeon, standing on the left side of the patient, makes an incision from three and a half to four inches in length, commencing at the pubic symphysis, and extending upwards towards the umbilicus, in the direction of the linea alba. It should pass through the skin and cellulo-adipose substance, down to the aponeuroses of the abdominal muscles. These structures, being thus exposed, are next cautiously divided to the same extent, any bleeding vessels being at once secured.

The bladder will be found at the bottom of the wound, forming a tolerably large, fluctuating tumor, invested merely by a thin layer of cellular tissue. To divide this, a few gentle touches of the knife are sufficient; or, what is better and more safe, the dissection may be effected with the steel end of the handle of the instrument. If the bladder is not sufficiently prominent, it should be rendered so by the introduction of a sound through the urethra. In either case, it is a matter of paramount importance to secure the organ with a tenaculum before it is incised, in order to prevent it from collapsing, and so sinking down behind the pubic bones; an occurrence which could not fail greatly to embarrass the subsequent steps of the operation. A puncture is next made into the anterior surface of the viscus, on a level with the pubic symphysis, large enough to admit the index-finger of the left hand, which is at once inserted, and used as a searcher, to ascertain the situation and volume of the stone. The opening is afterwards enlarged, with a probe-pointed bistoury, to any extent that may be required; the forceps are introduced, and the stone is seized and removed. A short silver tube, carefully rounded at the end, and pierced with numerous apertures at the sides, is now conveyed into the bladder, at the lower part of the wound, and secured by two pieces of tape fastened to a broad roller, the edges of the remainder of the wound being previously approximated by several points of the twisted suture, aided by adhesive strips.

Instead of the above procedure, which is often attended with much inconvenience and risk, the best plan is to close the wound in the bladder accurately by suture, introduced in such a manner as not to interfere materially with the serous investment of the organ. The operation, which was first performed by Professor Bruns, of Tübingen, ought, in my judgment, to supersede the ordinary and more hazardous procedure.



## GENERAL RESULTS OF THE DIFFERENT METHODS OF LITHOTOMY.

The following table presents the general results of the more important operations described in the preceding pages.

Methods.	Cases.	Cures.	Deaths.	Proportion.
Lateral operation . . . . .	5418	4829	589	1 in $9\frac{1}{2}$
Bilateral method . . . . .	207	175	32	1 in $6\frac{1}{2}$
Recto-vesical section . . . . .	83	67	16	1 in $5\frac{3}{8}$
Supra-pubic operation . . . . .	180	141	39	1 in $4\frac{8}{9}$
Total . . . . .	5888	5212	676	1 in $6\frac{1}{3}$

## STONE IN BLADDER OF THE FEMALE.

Women are much less liable to urinary calculi than men. The period of life at which they are most prone to suffer is from the twentieth to the fiftieth year. The symptoms which attend the affection are similar to those which characterize it in the other sex.

In sounding, the patient is placed upon her back, on the edge of the bed; and the instrument, a short steel rod, slightly curved at the extremity, is carried about through the interior of the bladder, so as to explore, if necessary, every recess of this organ. In young children, the finger may, if deemed advisable, be inserted into the rectum; but in grown subjects it is best always to introduce it into the vagina.

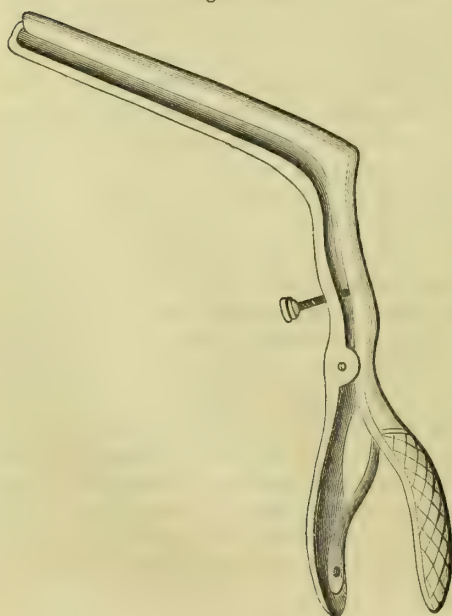
Quite a number of cases are upon record in which calculi of large size have been expelled spontaneously from the female bladder. The extrusion is sometimes effected suddenly, but, in, general, it is ac-

complished slowly, and with more or less pain and difficulty in voiding the urine.

The common plans of operation, for removal of stone from the female bladder, are dilatation of the urethra, crushing, and incision.

The method by *dilatation* is liable to be followed by incontinence of urine, in consequence of which it has of late years fallen very much into disrepute. It is more particularly adapted to small concretions, unaccompanied by any serious disease of the urethra and the neck of the bladder. The dilatation may be effected slowly, or rapidly, by means of instruments especially contrived for the purpose, as the one sketched at fig. 477, or

Fig. 477.



by sponge tents, bougies, or catheters. I commonly use the latter, especially at the beginning, and one of gum is preferable to one of silver. When the stone is small, the necessary dilatation may be effected in a few hours, or, at all events, in a few days.

*Crushing* may be employed when the stone is comparatively soft, and yet so large as to render it impossible to extract it without undue dilatation of the urethra. The object may be effected either with a small pair of lithotomy forceps, rather narrower than common in the blades, or with any of the ordinary lithotriptors.

The operation of *lithotomy* is easy of execution, perfectly free from danger of hemorrhage, and not liable to be followed by incontinence of urine. The only instruments which are required for its performance are a straight staff, five inches in length, and a straight probe-pointed bistoury. The staff (fig. 478) being introduced, an in-

Fig. 478.



cision is made directly upwards towards the pubic symphysis, extending through the urethra and the neck of the bladder, in their entire length. The opening may afterwards, if necessary, be dilated with the finger to almost any extent that may be required for the safe and easy extraction of the calculus. When the concretion, however, is of unusual magnitude, and cannot be thus removed, the incision may be extended downwards and outwards towards the tuberosity of the ischium.

A modification of the above operation, consisting of dilatation and incision, may sometimes be advantageously employed. After dilatation has been practised to a sufficient extent to admit the index-finger, the tube is divided in one half of its length, either anteriorly or posteriorly, according to the judgment of the surgeon. The great object of this procedure is to prevent incontinence of urine.

#### FOREIGN BODIES IN THE BLADDER.

The foreign bodies that may find their way into the bladder are too diversified in their character to admit of any very precise enumeration. The most common, however, as well as the most important, are balls, pins, needles, fragments of bone, pieces of straw, or other vegetable substances, and bits of catheters and bougies.

Such bodies may be introduced into the bladder either accidentally, or, they may be thrust up designedly, but with no intention of leaving them in this unfortunate situation. However this may be, the effects upon the foreign substance and the bladder are generally similar, or, at any rate, if they differ at all, they differ only in a very slight degree. The extraneous body usually becomes incrustated in a very short time with earthy matter, sometimes attaining a large bulk in a few months.

Foreign bodies, introduced into the bladder, occasionally perforate its wall, and escaping into the peritoneal cavity, excite fatal inflammation. The occurrence of such an event will, of course, depend upon the form and consistence of the foreign substance.

The extraneous body, if small, may be expelled spontaneously; but, generally speaking, it must be extracted by operation. A bullet of ordinary size might be removed simply by dilating the urethra; or, this failing, by Cooper's forceps. When the foreign body refuses to come away of its own accord, or the forceps are unavailing, relief must be attempted by the lateral operation.

Many cases are upon record, where bits of gum-elastic catheters and bougies were extracted from the bladder by means of the forceps, an excellent pair of which is represented in the annexed drawing (fig. 479). When the foreign body is a pin or a needle, it may sometimes be entrapped by the eye of a catheter, as in the memorable case of La Motte.

Fig. 479.



Fig. 480.



## SECT. II.—DISEASES AND INJURIES OF THE URETHRA.

### MALFORMATION.

The urethra is liable to a variety of malformations, which, though exceedingly rare, ought, nevertheless, to be well understood, on account of their great practical importance, and the sad effects which they exert upon the happiness of the poor sufferer.

The most common of these congenital vices are, first, closure or contraction of the meatus; and, secondly, absence, contraction, and change of form of the urethra.

The external orifice of the urethra occasionally deviates from its normal situation, lying much higher up or lower down than usual; and there are cases where it is either extremely small, or altogether occluded, thus interfering more or less completely with the passage of the urine. I have seen several instances of double meatus, in neither of which, however, more than one opened into the urethra, the other ending in a blind pouch.

The urethra may be absent, as is exemplified in extrophy of the bladder, in which both the urine and semen are discharged above the pubes. Authors have described what they call a double urethra, but



of such a malformation no well authenticated case has ever been reported. Sometimes the canal is bifid, or cleft, forming a kind of gutter, running along the dorsal surface of the penis, and constituting what is denominated *epispadias* (fig. 481). Occasionally, again, it is deficient in front, but well formed behind, terminating, however, always in a narrow orifice, admitting of an imperfect discharge of the urine. It is to this variety of malformation that the term *hypospadias* has been applied.

Some of these defects are, of course, irremediable; others, however, admit of relief.

Occlusion of the external meatus always demands prompt interference. When it is caused simply by a duplicature of the lining membrane, forming a sort of hymen, a vertical incision in the direction of the natural outlet is generally all that is required; the edges of the wound being kept asunder by means of a bougie. When the imperforation depends upon the presence of fibrous tissue, and reaches a considerable distance back, the operation will be more serious, and will require to be performed with a trocar.

Hypospadias and epispadias are defects of a serious character, which, besides greatly inconveniencing their unhappy subjects, often serve as causes of impotence.

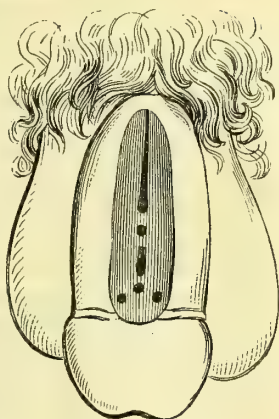
Hypospadias presents itself under three varieties of form, of which the most common, as well as the most simple, is the one in which the urethra opens just behind the frenum. In the second, the tube opens at some point intermediate between the first and the scrotum; and in the third, the urethra terminates at the latter organ, which is cleft at the middle line.

In the more simple variety of hypospadias, a cure may be attempted by paring the edges of the fissure and uniting them by means of interrupted sutures over a catheter introduced into the bladder. Any part that may remain unclosed may be touched with nitrate of silver.

The same mode of proceeding is adopted when the fissure exists further back, only that it will be necessary, in addition, to establish an artificial urethra by means of a trocar, pushed in the direction of the natural channel. The canal is kept pervious by a catheter, until it has received a mucous lining, after which the instrument should be worn a few hours every day for a number of months.

The treatment for epispadias is conducted upon the same principle as that for the different varieties of hypospadias just described. In a case treated by Mr. Liston, in which nearly four inches of the urethra were exposed, a complete cure was effected in a few days. The operation consisted in paring the edges of the cleft thoroughly, and putting them together over a catheter, by means of many points of the twisted suture. Union by the first intention took place in the entire track, except near the pubes, where a very minute fistulous opening remained,

Fig. 481.



through which not more than a drop of urine oozed during micturition. This was afterwards closed with a heated needle. The organ was, in all respects, and for all purposes, as perfect as could be desired.

#### LACERATION.

The urethra is liable to laceration by causes acting either from without, or from within. Under the first head may be comprised falls, blows, and kicks upon the perineum, or the perineum and penis; under the second, injury done by the lodgment of a calculus, and the rude, forcible, or injudicious use of catheters, bougies, and sounds.

Laceration of this canal occasionally takes place under a violent erection, especially if the penis, while in this condition, happens to be struck accidentally against a hard, resisting body. The accident has also been known to occur during convalescence, after attacks of fever. The rent may be limited to the mucous membrane, or it may involve along with it all the tissues which intervene between the canal and the external surface.

The *symptoms* of this affection are generally sufficiently characteristic. The most prominent are, pain in the affected part, hemorrhage, inability to void the urine, or the discharge of this fluid in a small and imperfect manner, discoloration of the perineum, or of the perineum, scrotum, and penis, and great difficulty, if not utter impossibility, of introducing the catheter. The patient is weak and faint, perhaps sick at the stomach, and labors under all the effects of a severe shock.

The *treatment* of this accident must be prompt and decisive, as there is great danger of infiltration of the cellular tissue of the perineum, and scrotum, from the escape of the urine. If the rent be small, the first thing to be done is to pass a catheter into the bladder, one being selected that is rather over than under the ordinary size. If, on the contrary, the injury is very extensive; or, if some hours have elapsed since its occurrence, and the symptoms indicate urinary infiltration, no time is to be lost in making numerous and deep incisions into the affected parts. In conjunction with this treatment, local bleeding, purgatives, the warm bath, anodynes, fomentations, and poultices may be advantageously employed.

#### HEMORRHAGE.

Hemorrhage of the urethra, although uncommon, is always alarming to the patient, and often a source of much embarrassment to the practitioner. It may present itself under two varieties of form, the spontaneous and traumatic, of which the latter is the more frequent.

Spontaneous hemorrhage is met with chiefly in elderly and middle aged persons, who have led a life of irregularity and debauch. It occasionally occurs during a violent erection of the penis.

Traumatic hemorrhage, on the contrary, usually depends upon direct violence, as, for instance, that caused by the passage of a urinary concretion, the introduction of instruments, or attempts to force a stricture.

It is a very common consequence of injury of the perineum. The bleeding, however induced, is seldom copious.

Hemorrhage of the urethra rarely requires surgical interference; in most cases it either ceases spontaneously, or it is easily arrested by repose in the horizontal position upon a hair mattress, by iced drinks, and by pressure, for a few minutes, upon the perineum, directly opposite to the part from which the blood proceeds. A cold enema sometimes puts a sudden stop to it. Cold and astringent injections into the urethra, thrown high up, are also beneficial. When the case is obstinate, compression may be made by means of a large catheter, introduced into the bladder, and supported with the bandage, the finger, or adhesive strips. The most efficient internal remedies are gallic acid and subacetate of lead, in combination with opium. Alum, given in large doses, is also useful. In very obstinate cases, recourse may be had to spirits of turpentine and the tincture of the chloride of iron, in doses of ten drops each, repeated every hour.

#### FOREIGN BODIES.

Foreign bodies in the urethra may, as to the sources from which they are derived, be arranged under two heads: 1st, foreign bodies which descend from the urinary bladder, or which are developed in the canal itself; and, 2dly, substances forced into the urethra through its natural orifice.

1. *Foreign Bodies which descend from the Bladder, or are developed in the Urethra.*—Most of the foreign bodies which descend into the urethra from the bladder, are simply earthy concretions, which are developed either in the latter organ, in the prostate gland, or in the kidneys. Sometimes, however, they consist of articles which were originally admitted through the urethra, and which have afterwards, in consequence of the force impressed upon them by the bladder in micturition, taken a retrograde course. The concretion may be developed in the urethra itself, but this is rare.

The passage of a calculus from the bladder along the urethra is frequently productive of great inconvenience and distress. The intromission is generally sudden and unexpected, taking place while the patient is engaged in micturition. It is instantly followed by an interruption of the stream of urine, an urgent desire to empty the bladder, severe straining, more or less pain, and a sense of burning or tearing in the urethra. If the substance is small, it may be expelled in a few minutes; if, on the contrary, it is disproportionably bulky, it may be permanently arrested, and give rise to severe suffering, accompanied by retention of urine, painful erections, and probably, also, by slight hemorrhage from laceration of the mucous membrane.

The *symptoms* which attend the passage of a calculus along the urethra, may be simulated by those produced by other causes; therefore, to establish the diagnosis it is necessary to institute a careful examination with the finger and the catheter. When the substance is situated far back, as in the membranous or prostatic portion of the urethra, the exploration must be conducted with the finger in the



rectum. In using the catheter, care should be taken that the substance be not pushed back into the bladder. It is worthy of remark that, when the calculus has escaped from the urethra and lodged in the subjacent structures, the instrument may fail to detect it, even when it is of large size.

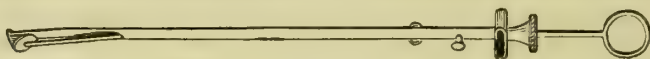
A calculus, after having remained in the urethra for an indefinite period, sometimes effects its own expulsion, by exciting absorption, and finally, ulceration of the surrounding tissues.

When the foreign body is lodged in the posterior portion of the tube, and is obstructing the flow of urine, the safest plan is to push it back into the bladder; whereas, if it is comparatively small, or unusually rough, it should be removed. Before doing this, however, an attempt should be made to favor its expulsion by dilating the urethra. Occasionally extrusion may be effected by injections of sweet oil, or by closing the prepuce, and holding it tightly while the patient is making a powerful effort at micturition, at the same time that pressure is applied along the under surface of the urethra, to urge on the foreign body.

When the calculus occupies the spongy portion of the tube, it ought to be extracted, whatever may be its size or form, provided it cannot be extruded during micturition. When it is situated near the orifice of the urethra, it may be removed by a pair of narrow-bladed dissecting forceps, but when it is lodged far back in the canal, a wire-loop, as originally suggested by Marini, may be used. The only objection to this instrument is the difficulty of passing it behind the concretion, which, when large enough to lodge, usually fills up the entire passage.

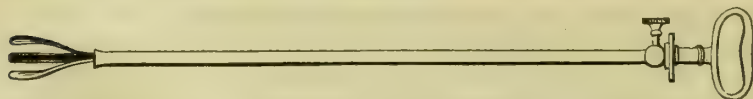
When these simple means fail, recourse must be had to the urethral forceps, of which there is a great variety. The one to which I give the preference, is the articulated scoop (fig. 482) of Bonnet, of Lyons,

Fig. 482.



but it is applicable only to small substances. It is armed with a stylet, and is furnished with a head for seizing and fixing the foreign body. The instrument, well oiled, is introduced in contact with the concretion, when its blades are expanded over it; the extraction being effected in the most slow and gentle manner, to prevent injury of the mucous membrane. Fig. 483 represents Hunter's forceps, as improved by modern surgeons, for extracting urethral calculi.

Fig. 483.

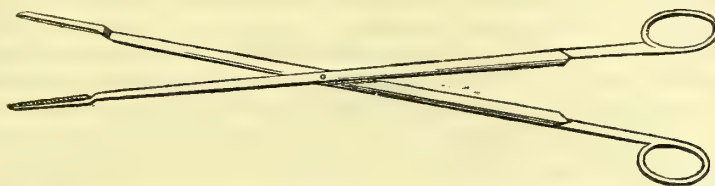


*Crushing* is applicable only when the calculus is soft or friable; but as this can hardly ever be known beforehand, it is rarely available. The operation, moreover, is seldom safe.

*Excision*, which becomes necessary when extraction fails, varies according to the situation of the foreign body. When the concretion is lodged in the prostatic or membranous part of the tube, it is performed very much after the manner of Celsus, in cutting on the gripe, the left index-finger being inserted into the rectum, to protect the tube from harm, and a small incision being made in the direction of the raphé of the perineum.

When the calculus is impacted in the navicular fossa, or even farther back, its extraction may generally be easily effected with the forceps represented in fig. 484. Or, this failing, an incision may be

Fig. 484.



made over it, along the lower part of the urethra, where this tube corresponds with the head of the penis.

When the foreign body lies in that portion of the urethra which corresponds with the scrotum, incision should be practised with great caution, from the fact that it is liable to be followed by infiltration of urine, and all the bad consequences of this accident. In such a case, I would advise immediate cauterization of the wound with nitrate of silver, to favor the deposit of lymph, and an avoidance of micturition until the parts have become fully consolidated. Or, instead of this, an incision might be made through the skin and cellular tissue over the tumor, and the wound stuffed with lint. The requisite amount of inflammation having been excited, the operation is completed by dividing the parietes of the urethra in the usual manner.

2. *Foreign Bodies introduced from without.*—Of foreign bodies introduced into the urethra from without, the number and variety are quite considerable. The occurrence is sometimes fortuitous, but more frequently it takes place through design. Bits of catheters, bougies, quills, pipe-stems, wood, straw, and other substances have been accidentally lodged in the urethra, by individuals endeavoring to draw off their urine, relieve a stricture, or provoke onanism.

Foreign bodies, introduced into the urethra from without, have a great tendency to pass into the bladder, owing to the suction power of this organ. Very frequently, however, they become impacted in the tube, and they may then, unless they are situated very far back, be usually readily extracted with a pair of delicate forceps, such, for instance, as those represented in fig. 484.

#### MORBID SENSIBILITY.

This affection consists mainly, if not exclusively, in an exaltation of the natural sensibility of the mucous membrane of the urethra. It

is quite frequent in both sexes, but is much more common in men than in women.

It is not always easy, or even possible, to ascertain the nature of the exciting *causes* of this affection, so diversified are they in their character. In the male it is often dependent upon the effects of gonorrhœa and gleet, stricture of the urethra, and enlargement of the prostate gland; and, in both sexes, upon disorder of the bladder, the kidneys, ureters, anus, and rectum. Morbid sensibility of the urethra sometimes attends inflammation, ulceration, and other disorders of the uterus, the vagina and vulva. A morbid state of the urine may not only induce it, but maintain it for an indefinite period. Of all the causes, however, onanism and inordinate sexual indulgence are, I have reason to believe, the most common.

The *symptoms* of this disease are subject to great diversity, both as it respects their nature and degree. In the more simple forms, there is merely an exaltation of the normal sensibility of the mucous membrane. When the affection is more fully developed, the local distress is not only more severe but often extends to the surrounding parts, as the perineum, the groin, anus, pubes and genital organs. The bladder also suffers sometimes sympathetically, and at other times from a positive extension of the disease. Occasionally the symptoms resemble those of stone in the bladder. When the disease exists in this aggravated form, there is always marked disorder of the general health. When the posterior portion of the tube is involved, seminal emissions are apt to take place. The urine is variously altered in its properties; in general, it contains an undue quantity of mucus, and not unfrequently it exhibits, under the microscope, different deposits, especially oxalate of lime and phosphates.

The best mode of determining the precise nature of this disorder is the introduction of the catheter. One of medium size is selected, and is passed with the greatest care and gentleness. By this means we are able to ascertain the extent and degree of the sensibility, and also whether there be a stricture of the urethra, enlargement of the prostate gland, or disease of the bladder. It should be remembered that the healthy urethra is often extremely sensitive on the first introduction of a catheter.

The true *pathology* of this disease is not accurately determined. There is no doubt that it is occasionally caused by inflammation, either subacute or chronic in its character; but very frequently it appears to be owing merely to an exaltation of the normal sensibility of the mucous membrane.

In the *treatment* of this affection, one of the first objects should be to find and remove the exciting cause. In general, marked relief will follow the use of antiphlogistics, assisted by the exhibition of the bicarbonate of soda, either alone or in union with uva ursi and hop-tea, mild laxatives, and anodyne injections, with the addition of a small quantity of acetate of lead, Goulard's extract, sulphate of zinc, or nitrate of silver. The general health should be attended to. The introduction of a full sized catheter, at first once and afterwards twice a day, will sometimes be productive of the best results. In this way,



moreover, the affected surface may be directly medicated; the dilute ointments of nitrate of mercury and belladonna are, especially if used in combination, entitled to the first rank in the list of this class of remedies. When there are involuntary seminal emissions, hardly anything short of cauterization of the prostatic and membranous portions of the urethra will be likely to succeed. Whatever mode of treatment be adopted, the patient should refrain from sexual indulgence and exercise on horseback.

The best internal remedy, when there is no appreciable local cause for the disease, is, on the whole, the bromide of potassium, given in solution, in doses varying from eight to ten grains three times a day. It seems to act as a sedative, and to make a direct impression upon the affected parts.

#### NEURALGIA.

It is not surprising that the excretory canal of the urine should be liable to neuralgia, especially when we consider its structure and functions, and the various sources of irritation to which it is subject. The disease is most common soon after the age of puberty, in persons of a nervous, excitable temperament. It is much more frequent in males than in females.

Its origin is generally obscure. It may be caused by external injury, onanism, or frequent sexual intercourse. It is sometimes dependent on a miasmatic impregnation of the system.

The pain is of a sharp, pricking character, darting about in different directions with the rapidity of lightning; it often remits or intermits for a few seconds, and then recurs with its former violence; it is generally attended with considerable soreness of the urethra and penis, a frequent desire to micturate, and scalding in voiding urine. In some cases the disease is periodical.

The *treatment* of this affection is to be conducted upon the same principles as that of neuralgia in other parts of the body. The cause is, of course, if possible, removed, when recourse is had to quinine, arsenic, strychnine, and aconite. When the affection is of a purely miasmatic origin, no other treatment is generally required. In the milder forms of the disease, quinine alone will often speedily effect a cure. In obstinate cases, valerianate of iron sometimes succeeds when all other remedies fail.

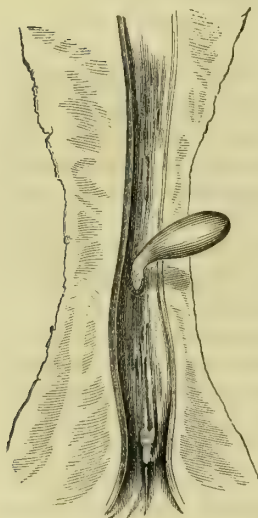
Little is necessary in the way of local treatment. During the paroxysm, the penis may be immersed in warm water, or fomented with hot cloths impregnated with laudanum. The veratria and belladonna ointment is sometimes of service. In some cases I have witnessed good effects, especially in cold weather, from making the patient constantly carry his penis in a thick flannel stall to protect it from atmospheric vicissitudes. It need scarcely be said that all sexual intercourse should be avoided.

## POLYPOID TUMORS.

These tumors occur in both sexes, and in different portions of the urethra. In the male, the most common site is the anterior part of the tube, just behind the urinary meatus. In women they are also generally situated superficially, sometimes projecting beyond the external orifice of the urethra.

In the male, these growths are generally small, their volume rarely exceeding that of an apple-seed. They are of a soft, spongy consistence, of a red color, and of a pyriform, conical, or spherical shape, their attachment being usually by a small pedicle. In general, they are solitary, but I recollect one instance in which there were not less than three, situated close together. Their surface is sometimes perfectly smooth, at other times slightly granulated, rough, or studded with villousities. In regard to their structure, they consist of a cellular, or cellulo-vascular substance, invested by a prolongation of the lining membrane of the urethra. A good idea of this variety of morbid growth is afforded by fig. 485, copied from Mr. Thompson.

Fig. 485.



Polyp of the urethra.

These polypoid tumors are generally free from pain, in which respect they differ remarkably from the vascular growths in and around the female urethra. They are usually attended by a thin, gleetty discharge, but they seldom materially obstruct micturition. Their development is tardy and insidious, and they usually manifest no disposition to reappear after extirpation. When deep-seated, they may exist for years, without the possibility of detection.

The removal of these excrescences is best effected by excision with the knife or scissors. The surface should always be touched immediately after with nitrate of silver or sulphate of copper.

## STRICTURE.

A stricture is a diminution of the caliber of the urethra, either of a transient or permanent character. The affection, in the former case, commonly depends upon a spasmodic contraction of the tube, and is hence known by the name of spasmodic stricture; it lasts only for a short time, is paroxysmal in its nature, and often disappears as suddenly and unexpectedly as it comes on. In the latter, on the contrary, it is always caused by an effusion of lymph into the lining membrane and the subjacent cellular tissue of the urethra, where a portion of this substance remains, and ultimately becomes organized. To this form of coarctation, to which the succeeding remarks will be

limited, the term organic is usually applied, and, as signifying the same thing, the word permanent is occasionally employed.

Organic stricture presents itself in various forms. Thus, it may be simple or complicated, common or traumatic, partial or complete, soft or callous, dilatable or undilatable, permeable or impermeable, recent or old; terms which sufficiently explain themselves.

Much diversity prevails in relation to the seat, number, form, consistence, and extent of organic strictures.

No part of the urethra, except, perhaps, the prostatic, is entirely exempt from this disease. The results of my observations lead me to infer that the affection is most common, first, in that portion of the urethra which is comprised between the scrotum and the head of the penis; secondly, at the membranous part of the tube, or at the junction of this and the bulbous part; and, lastly, at the anterior extremity within a few lines of the meatus. Stricture at the prostatic portion of the canal is altogether an imaginary occurrence.

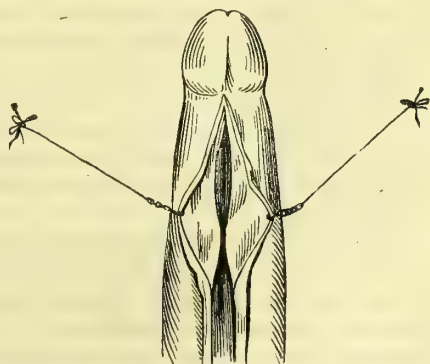
The seat of this disease has recently been very carefully examined by Mr. Henry Thompson, of London. The number of specimens inspected by him was 270, embracing 320 distinct strictures. Of these, 215, or 67 per cent. of the entire number, were situated at the junction of the membranous and spongy portions and its vicinity, 51, or 16 per cent., in the centre of the spongy portion, and 54, or 17 per cent., at the external orifice, and within two inches and a half behind this point. In 226 cases, the stricture was single, and in 185 of these, it was situated at the posterior part of the membranous portion, and in 24, in the anterior.

In the majority of cases, there exists but one stricture; frequently, however, I have seen two, and occasionally I have met with three, and even four. Hunter saw an instance of six, Lallemand, of seven, and Colot, of eight.

A very common *form* of stricture is that in which the urethra exhibits the appearance as if a thread or piece of twine had been tied around it. It may embrace the entire circumference of the tube, or only a part of it, and varies in its antero-posterior extent from half a line, or even less, to several inches (fig. 486). I have seen the contraction involve nearly the whole length of the canal.

A very rare form of the disease, called the *bridle stricture*, is occasionally met with. In this variety the urethra is obstructed by a small, narrow band, which is stretched across the tube, from one side to the other. Occasionally it is arranged so as to divide the passage into two parts.

Fig. 486.





The contracted portion may be soft and elastic, or hard and firm, according to the duration of the disease, and the degree of transformation of the effused lymph, upon whose presence it essentially depends.

Are strictures of the urethra ever *impermeable*? Much has been said and written upon this subject, especially of late, and it is, therefore, very important that the meaning of the term should be clearly defined, and accurately understood.

As long as a stricture admits of the discharge of urine, it cannot, in the true sense of the term, be considered as impermeable, although it may be impassable by the bougie, sound, or catheter. A stricture that is impermeable to urine is very uncommon; nevertheless, it occasionally occurs, both in the male and female. It has been asserted that there is no stricture that is impermeable to an instrument of some kind or other; that whenever there is room enough for the passage of urine, there is space enough for the introduction of a bougie or probe; and that, when the surgeon fails to accomplish his object, his want of success is attributable rather to his own awkwardness than to the nature of the obstruction.

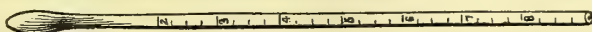
But the fact that this form of stricture is ignored by certain pathologists, by no means proves that it does not exist. The urethra, for example, may assume a zigzag direction, or there may be a multiplicity of coarctations, so seriously changing the natural relations of the tube as to offer an insurmountable obstacle to the passage of the smallest instrument in the hands of the most adroit and accomplished operator; but I go farther, and assert, upon the testimony of personal experience, that there is a class of strictures, the result of ordinary causes, which, while they admit of the flow of urine, slowly and imperfectly it may be, do not permit the introduction of any instrument, however small, into the bladder.

The *symptoms* of stricture, considered generally, are a diminution of the stream of urine, which is usually spiral, forked, or dribbling; frequent, slow and difficult micturition, often preceded, accompanied, or followed by a sense of scalding; a discharge of thin, gleety matter from the urethra; uneasiness about the loins, perineum, and anus; pain in coition; nocturnal emissions; elongation and thickening of the penis; and hardness at the seat of the obstruction, detectable by the finger. During the progress of the disease, the patient is liable to be troubled with swelling of the testicle, chordee, hemorrhoids, hernia, and retention or incontinence of urine. The general health is variously affected, and the slightest exposure, fatigue, intemperance, or irregularity in eating, is apt to be followed by an exacerbation of the local suffering.

Although the above symptoms are, in general, sufficiently denotive of the real nature of the disease which produces them, they can, nevertheless, not be regarded as pathognomonic. To establish, in an unequivocal manner, the *diagnosis* in any given case, it is indispensably necessary to explore the urethra with some instrument. The one which I usually select for this purpose, is a common silver catheter, of moderate size, and a little conical at the extremity, which is passed down the tube, first to the obstruction, then into it, and, lastly, if pos-

sible, beyond it. In this manner we may easily obtain an idea of the seat and extent of the stricture, as well as of its consistence. Where greater accuracy is required, I use a wax bougie, which is carried slowly down to the obstruction, upon reaching which the penis is pulled slightly forward, over it, and a mark made upon it with the thumb-nail immediately in front of the head of the organ. This will indicate the precise distance of the stricture from the external orifice of the urethra. I never employ the graduated bougie (fig. 487), so much used by the French surgeons. The gutta-percha bougie

Fig. 487.



is liable to break in the urethra, and should, therefore, be avoided. All examinations of this kind should be conducted with the utmost gentleness and deliberation. By slow and cautious manipulations, the point of an instrument may often be insinuated into the tightest stricture, or into one so tender and irritable as to resent every attempt of an opposite description.

A tolerably correct idea of the nature, seat, and extent of a stricture, may sometimes be acquired by the application of the thumb and finger along the under surface of the penis. These remarks, are, of course, chiefly applicable to strictures of the spongy portion of the urethra.

The *pathological effects* of stricture deserve particular study. The affection seldom exists long without giving rise to disease in the adjoining and associated parts. The organs, which, besides the urethra, are most liable to suffer, are the prostate gland, the bladder, ureters, and kidneys. The testes, penis, seminal vesicles, perineum, and rectum, also not unfrequently participate in the evils consequent upon the malady.

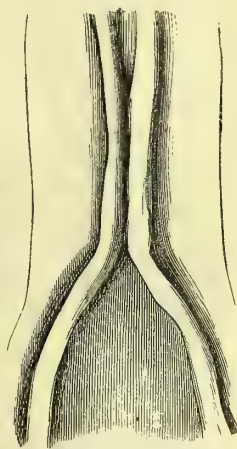
An occasional, as well as a most serious, effect of stricture is a dilatation of the urethra behind the seat of the obstruction (fig. 488). This is evidently owing to the manner in which the urine is habitually impelled against the stricture. The urethra in front of the obstruction, is either normal, diminished, or dilated.

Another consequence of stricture is the development of fistule in the perineum, caused by ulceration or rupture of the mucous membrane behind the seat of the obstruction, and the escape of a small quantity of urine in the subjacent tissues.

The most common lesion of the prostate, in tight, callous and protracted stricture, is inflammation of the substance of the organ, eventuating occasionally in the development of an abscess, the formation of calculous concretions, or in great atrophy. Sometimes the gland is converted into a membranous pouch.

The bladder, in confirmed cases, soon becomes hypertrophied, and

Fig. 488.



finally sacculated. Another occurrence, worthy of passing notice, is the proneness, in patients affected with this malady, to the development of urinary calculi.

The most common lesion of the ureters is inflammation of their lining membrane, suppuration and deposits of lymph, and irregular dilatation of their caliber. Their parietes are often greatly thickened.

The kidneys are variously affected in this disease. Inflammation frequently occurs at an early period, and gradually progresses until it ends in serious mischief, if not in total ruin of the affected organ. The adjoining sketch (fig. 489) strikingly illustrates the effects of stricture of the urethra upon the rest of the urinary organs. The prostate gland is completely destroyed, the mucous membrane of the bladder is removed by ulceration, the ureter is immensely enlarged, and the kidney is converted into a mere shell, which was filled at the time of the dissection with purulent matter. The drawing is from a specimen in the pathological collection of the New York Hospital.

Fig. 489.



The *causes* of stricture may be conveniently arranged under two heads, the traumatic and the inflammatory. Of these, the latter are by far the more common. The particular kind of injury is generally a blow, fall, or kick upon the perineum, eventuating in a contusion or laceration of the lining membrane, or of this membrane and the subjacent tissues. A bad stricture sometimes results from violence inflicted by a catheter or a bougie. The cicatrice, left after lithotomy, has sometimes been succeeded by obstinate contraction.

Of the inflammatory causes of stricture, by far the most frequent is, unquestionably, gonorrhœa. It has been supposed that stimulating injections, employed too early in this disease, are capable of produc-

ing the affection; this is undoubtedly true, but I am satisfied that the occurrence is much less frequent than is generally imagined.

Finally, stricture is occasionally produced by chancre of the urethra. The obstruction, when thus induced, is generally situated at the anterior extremity of the urethra, just behind the external orifice.

The *prognosis* of this disease is variable. Stricture, if taken before it has become hard or firm, or while it is still recent, and before it has given rise to any serious lesion of the urinary apparatus, is, in general, neither dangerous nor difficult of cure. When, however, it has made



considerable progress, offers much resistance to the passage of the urine, and has excited inflammation in the neighboring organs, it may be considered as a very serious affection, liable, if permitted to proceed, to be followed by the worst consequences. As a general rule, it may be stated that a recent stricture is much more easy of cure than an old one; a small, than a large one; a soft, than a callous one; an inflammatory, than a traumatic one. Furthermore, a stricture of the membranous portion of the urethra is usually more difficult to manage than one of the spongy. An obstruction in this situation is also more liable, as a general principle, to awaken serious disease of the prostate gland, bladder, ureters, and kidneys.

When the stricture is obstinate and protracted, it may gradually so far undermine the general health as to cause death. Sometimes the brain sympathizes with the urinary troubles, and a slow, subacute inflammation, attended with coma, is set up in this organ and in the arachnoid membrane, eventuating at length in fatal serous effusion.

*Treatment.*—Various methods have been employed for effecting the permanent cure of stricture. Of these the most important are dilatation, compression, cauterization, incision, and external division, each of which has been more or less modified, according to the wants, whims, or caprices of different practitioners.

Before resorting to any of these expedients, it is of paramount importance to attend to the general health, and to subdue local inflammation. When the way has been thus paved, the particular kind of treatment is to be determined by a careful consideration of the obstruction.

1. *Dilatation.*—This process was applied to the cure of stricture at an early period of the profession, and was for a long time the only one in use. Various instruments have been recommended for effecting the dilatation. The most common are bougies, made of different materials, shapes, and sizes. The fact is, almost any substance, provided it is not too brittle, and admits of a good polish, may be used for the purpose.

Bougies are straight or curved, solid or hollow, cylindrical or conical, flexible or inflexible, according to the choice of the operator, or the exigencies of each particular case of stricture. The vesical extremity of a bougie may be fusiform, olive-shaped, conical, or cylindrical, as in the annexed cuts (figs. 490, 491, 492, and 493). Much importance has been ascribed to this circumstance, and yet, strange to say, nothing definite has been agreed upon. If there be any preponderance of weight, it is, perhaps, in favor of the conical shape, as this is generally most in accordance with the form of the stricture which the instrument has to penetrate.

Fig. 490. Fig. 491. Fig. 492. Fig. 493.



The length of a bougie varies from a few inches to that of the ordinary catheter. When the obstruction is situated at the anterior part of the tube, a short instrument is commonly more convenient and manageable than a long one.

My conviction, founded upon ample experience, is, that the very best instrument for dilating a stricture is the common silver catheter, with a slightly conical point. I have now employed this instrument in the treatment of this affection for upwards of twenty-five years, and nothing could induce me to abandon it. It combines all the requisites that such an instrument ought to have, being light, firm, and durable. Independently of other considerations, a very strong reason for preferring a silver catheter to every other contrivance for dilating strictures, is the fact that it is often necessary to retain the instrument in the bladder, both for facilitating the cure, and drawing off the urine.

In performing the operation the same rules are to be observed, as it respects the position of the patient, the situation of the surgeon, and the warming and oiling of the instrument, as in ordinary catheterism. The instrument, a small or middle sized catheter, slightly conical at the extremity, is passed as gently as possible to the seat of the obstruction. Waiting a few moments, to enable the parts to accommodate themselves to its presence, it is gradually insinuated into the stricture, either by a steady backward pressure, or by a sort of rotatory movement, and is afterwards passed on into the canal beyond it. When this object has been accomplished, the instrument is either almost immediately withdrawn, or it is conveyed into the bladder, and retained there for the next twenty-four hours, or, perhaps, even a longer time. The latter course is the one which I usually adopt. By this method I have frequently succeeded in restoring the urethra to its natural size in a few days, and that, too, when the disease was of quite an obstinate character. When the dilatation is conducted upon this principle, it will sometimes be advantageous to use several catheters in succession, beginning with one that will readily enter and pass the stricture, and immediately after substituting one of larger diameter.

When the operation is thus forcibly performed, it is liable to be followed by inflammation of the urethra, and sometimes even of the neck of the bladder and the prostate gland. I have never, however, known it to assume a serious character from this cause in any case. Still, such an event might happen, and it is important that the young practitioner should be aware of the fact. Considerable bleeding sometimes attends the operation, and now and then it is followed by severe pain, rigors, and high fever.

But dilatation is not always performed in this rapid and forcible manner. There is another mode of conducting it, more slow and gradual, if not more safe and free from suffering. The rule, in this case, is to proceed as cautiously and gently as possible, so as to avoid all risk of irritation, commencing with an instrument that will readily pass the obstruction, and using afterwards a series of steadily increasing sizes until the cure is perfected. The introduction is repeated, at first, every second or third day, and subsequently, when the canal has

become more tolerant of the operation, once every twenty-four hours. When the dilatation has advanced considerably, it is a good plan occasionally to pass a small catheter, followed immediately by a larger one, which may be carried into the bladder and then almost instantly withdrawn. The obstacle is usually surmounted, by this method, in from one to two months, according to circumstances.

In whatever manner the dilatation is conducted, it is of paramount importance, after the cure is apparently completed, to introduce occasionally a large-sized catheter as far as the bladder. If this precaution be neglected, the practitioner will soon have the mortification to find that the disease will return, perhaps even with increased force, thus imposing the necessity of subjecting the patient to another course of treatment.

When the object is to dilate the parts very gradually, or when the process is obliged to be steadily maintained for a long period, benefit may be derived from the employment of the slippery-elm bougie. This is made of the inner bark of the tree of this name, of cylindrical form, with a slightly conical extremity, and of suitable size.

The process of dilatation is mainly applicable to soft and recent strictures.

2. *Compression*.—When the stricture is so hard and tight that it cannot be penetrated in the usual manner, an attempt may be made to remove it by pressing the end of the instrument against its anterior extremity. The operation is conducted upon the same principles as in gradual dilatation. Ulceration and suppuration occasionally follow this treatment, effects which should be carefully avoided.

I have not much experience with this mode of treatment, and I candidly confess that I have a feeling against it, amounting almost to aversion. The only case to which it seems to me to be at all applicable is, where the stricture is situated in the membranous portion of the urethra, and is so tough and narrow as to resist the ordinary method. A cure, if obtainable at all in this way, must necessarily be very tedious.

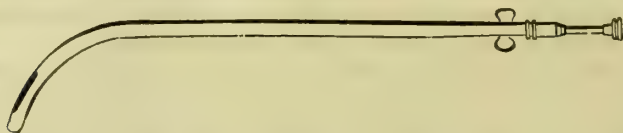
3. *Cauterization*.—Cauterization, properly used, is a valuable curative agent; but if indiscriminately employed, it is capable of doing serious, if not irreparable mischief. The circumstances to which it appears to be more particularly adapted, and to which, in my judgment, it ought to be restricted, are those in which the stricture, without being very tight or extensive, is of a firm, gristly and resilient character, and in which there is an undue amount of morbid sensibility of the mucous membrane of the urethra. It may be further observed that cauterization alone should seldom be relied upon, but that its action should always be aided by the bougie or catheter.

Cauterization, as practised at the present day, is generally effected with the nitrate of silver, applied by means of a porte-caustique, represented in the adjoining cut (fig. 494). It is fashioned like a common silver catheter, and is either straight or curved, according to the situation of the stricture. At the posterior surface of its vesical extremity is an eyelet, about three-quarters of an inch in length by a line and a



half in width which corresponds with the caustic in the cup, attached to a rod in the interior of the tube. The cup is partially filled with

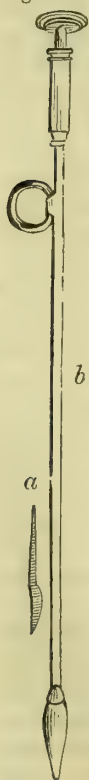
Fig. 494



simple cerate, or extract of hyoseyamus, which is next sprinkled with a thin layer of the powdered salt, when it is fit for use. Such an instrument is far preferable to the ordinary porte-caustique, which, from the peculiarity of its construction is liable to break off in the urethra, an accident which can never happen to this.

The patient, during the operation, observes the same posture as in ordinary catheterism. The instrument being conveyed down to the stricture, or, rather into it, the stylet, previously retracted, is now pushed on until the cup is opposite the eyelet previously described. Then, by a sort of rotatory movement of the tube, the caustic is brought

Fig. 495.



fairly in contact with the whole of the affected surface. The application, which is continued only for a few seconds, is renewed once every fifth or sixth day. It is usually attended with some pain, and is followed by a frequent desire to urinate, by a sense of scalding in the urethra, and by a thin, sero-sanguinolent discharge, which, in a short time, assumes a muco-purulent character, and generally disappears altogether, along with the other symptoms, in four or five days.

4. *Incision.*—When the stricture is very old, gristly, tight, and intractable, or indisposed to yield to dilatation, or dilatation and cauterization, incision must be used.

The instruments required for this operation vary according to the seat and nature of the stricture. When the coarctation is seated at the orifice of the urethra, or just behind it, a narrow-bladed, probe-pointed bistoury will answer every purpose; but for the remainder of the tube, the best urethrotome is one composed of a grooved canula, containing a stylet, armed with a little blade, which is made to project at will. The extremity of the canula, which is intended to lie within the stricture during its division, is of a conical shape, quite thin, and about three-quarters of an inch long. The instrument which I have been in the habit, for many years, of employing in permeable strictures, is exhibited in fig. 495; *a* representing the blade, and *b* the canula, with the stylet and blade retracted.

When the disease is situated just behind the opening of the urethra, I always employ a very narrow, blunt-pointed bistoury, with which the contracted part is freely divided in its entire length, either laterally, above and below, or at all

these situations, according to the nature and extent of the obstruction. For cutting a stricture situated between the head of the penis and the bulbous portion of the tube, a straight, lateral-bladed stylet is the most convenient. The conical extremity of the instrument being securely engaged in the contracted part, the penis is drawn forward, and the lancet pressed steadily against the resisting surface until it is completely divided at two, three, or more points of its circumference. For a stricture of the membranous portion of the urethra, the most suitable instrument is a curved perforator, used upon the same principle as the lateral-bladed stylet, but with a greater degree of caution, as this part of the canal is more intricate in its relations and direction. In whatever manner the operation is performed, the moment it is over a metallic catheter is passed into the bladder, and permanently retained there until the urethra has regained its natural character.

When the stricture is very large, or hard and tortuous, more than one operation may be necessary to effect its division; but, in general, I prefer to do all that is necessary at one time.

5. *Perineal Section.*—This is nothing less than the division of the stricture by an external incision, extending down through the urethra, and embracing the whole of the coarctated surface. The method was devised by Mr. Syme, of Edinburgh.

In performing the operation, which was originally described under the appellation of "external division," but which is now more generally known under that of the "perineal section," the patient is placed in the same position as in the operation for stone. A sound, slightly curved, and sufficiently small to pass readily through the stricture, is then introduced into the bladder, and intrusted to an assistant. The parts being shaved, the nates are brought to the edge of the table, and the surgeon, sitting on a low chair, or resting upon one knee, makes his incisions exactly in the middle line of the perineum, the raphé serving as a guide to the instrument. Having divided the superficial structures, he feels for the staff, and, plunging his knife into its groove, he cuts the indurated and contracted tissues through their entire extent, thus laying the surfaces completely open, precisely as in the operation for anal fistule. The whole wound does not exceed an inch and a half, and occasionally it need not even be so large. Care should be taken not to divide the deep fascia of the perineum, lest extravasation of urine take place. As soon as the stricture has been thoroughly opened, a medium-sized catheter is carried into the bladder, where it is retained by suitable apparatus, for at least forty eight hours, when it is removed and cleaned, and immediately reinserted.

Mr. Syme has lately constructed a staff for the purpose of simplifying the whole procedure, and thus enabling the surgeon to make his incisions with greater ease and precision. The instrument, which is represented in the annexed sketch (fig. 496), on a scale exactly half the length, but of its proper diameter, is very slender at the vesical extremity, and is thus readily passed through the stricture into the bladder, while the other portion, which is as large as a No. 8 catheter, stops abruptly in front of the obstruction, thereby indicating its anterior

Fig. 496.



limit, and the point, consequently, at which the incision should terminate in this situation.

The perineal section has met with much opposition, founded, in great measure, upon ignorance and prejudice, though there is no doubt that it has been much abused. When the cases are well selected, and the operation is properly executed, the effects are generally all that could be desired. Cases undoubtedly occur where it proves fatal, or where, especially if the after-treatment be neglected, it is followed by relapse, but such results are, in some degree, inevitable in all important operations performed for the relief of chronic disease of the urinary apparatus.

6. *Button-hole Operation*.—This operation, as the term *la boutonnière* literally signifies, is generally limited, at the present day, to impassable strictures, situated in the membranous portion of the urethra, or in that division of the tube which corresponds to the perineum, although Desault considered it as applicable to strictures admitting of the introduction of the staff. It would be well, I think, if the process could be made to include the external division of hard and impermeable coarctations, no matter in what part of the urethra they may be located. The effect of such an arrangement would be to avoid confusion between this operation and the perineal section, just described.

In performing this operation, the patient is placed in the same position as in lithotomy. A staff, or grooved director, either straight or slightly curved, is conveyed to the seat of obstruction, and confided to an assistant, who also holds up the scrotum. The incision is made into the raphé of the perineum, about an inch and a quarter in length, taking care, on the one hand, not to interfere with the rectum, and, on the other, not to extend it too high up towards the bulb of the urethra. The knife is plunged in, at the first stroke, to a considerable depth, and then divides, by successive touches, the parts covering the stricture. Feeling now for the end of the staff, the point of the instrument is inserted into the contracted part, which is next freely cut in a direction from before backwards. A catheter being introduced into the bladder, the case is managed, to all intents and purposes, as one of lithotomy. There is usually but little bleeding, and the wound seldom remains open beyond the fifteenth or eighteenth day. The treatment after the operation is conducted precisely in the same manner as in the case of the perineal section. The use of the catheter should be persisted in for a long time after the parts are cicatrized, otherwise



relapse will be inevitable, such is the tendency to contraction. When the operation has been well executed, the cure is generally permanent.

The procedure is by no means free from danger, and requires the most consummate skill for its successful execution. Several cases of this operation have been reported, in which death occurred in consequence of hemorrhage, shock, severe inflammation, or purulent infiltration.

*Injurious Effects of Operations on the Urethra.*—The different methods of treatment now described are all liable, however carefully or judiciously conducted, to be followed by very serious and even fatal consequences. It is well known that patients, especially such as are very nervous and irritable, occasionally suffer most violently from the most trifling operations upon the urinary organs.

In another class of cases, a still more serious effect is occasionally witnessed, as the result of operations upon the urinary organs, especially the urethra and the neck of the bladder. I allude to the occurrence of *pyemia*, or the formation of matter in the joints, muscles, veins, cellular tissue, and other structures. The disease sometimes resembles an attack of ordinary intermittent fever. Occasionally, again, it closely simulates gout or rheumatism. In whatever manner it makes its appearance, the case soon assumes a most threatening character.

In regard to the unpleasant nervous symptoms which occasionally succeed these operations, much may be done in the way of prevention by the use of chloroform; but when they are unavoidable, no time should be lost in moderating and relieving them. From one to two grains of morphia, according to the age and condition of the patient, are given at a single dose, along with a liberal quantity of brandy, or brandy and spirits of camphor. The extremities, and even the spine, are covered with sinapisms, and cloths, wrung out of hot water and laudanum, are steadily maintained upon the genitals, the perineum, and the hypogastrium. If undue reaction takes place, abatement may be sought with the lancet and tartar-emetic, or calomel and ipecacuanha; but these remedies must be employed with great caution, otherwise they may induce injurious debility.

Arthritic symptoms, and the formation of matter in the cellular tissue, joints, muscles, and viscera, must be met by leeches, blisters, iodine, and warm fomentations, medicated with laudanum and acetate of lead, and by the internal use of calomel and opium, aided, if necessary, by suitable stimulants, as carbonate of ammonia, quinine, wine, brandy, and porter. Superficial abscesses must be opened by early and free incisions, both to relieve pain and prevent further contamination of the system. Unfortunately, however, no mode of treatment, however early or judiciously employed, can avail much under such circumstances, death being the lot of almost every patient thus affected.

#### INFILTRATION OF URINE.

By the term "infiltration" as applied to the urine, is understood an escape of this fluid from the urinary passages, and its diffusion through

the surrounding tissues. There are two forms of this affection, the vesical and the urethral.

The accident, in whatever manner it may present itself, is always most unfortunate. The urine, playing the character of a violent poison, lights up severe inflammatory action, rapidly terminating in gangrene of the affected structures. The patient sinks into a low typhoid condition, which is speedily followed by extreme symptoms and death.

The *vesical* form of the lesion may be produced by a rupture of the bladder from external violence, from over-distention from urine, or from perforative ulceration of the coats of the organ. After lithotomy, infiltration is unfortunately but too common, especially in the hands of ignorant operators, and is one of the chief sources of danger.

The prognosis in vesical extravasation is generally most unfavorable, the treatment being in the highest degree unsatisfactory. When the urine has a tendency to advance towards the perineum, the great remedy obviously consists in making early, free and dependent incisions, to give vent to pent-up fluids, and in sustaining the system by the timely use of tonics and stimulants.

The *urethral* form of infiltration is more common than the vesical, and, in general, more manageable. If the rupture takes place in the commencement of the membranous portion of the urethra, behind the triangular ligament, the case may remain obscure for several hours, or even days. The most reliable symptoms of the accident are pain and deep-seated throbbing, difficulty, if not utter impossibility of voiding the urine, with, perhaps, a frequent desire to do so; a sense of fulness in the anus and rectum; tenderness in the hypogastrium; and excessive constitutional disturbance. By and by, the urine makes an effort to approach the surface, its progress being preceded and accompanied by heat, pain, redness and swelling, and by a rapidly increasing typhoid state of the system.

If the rupture occurs in that portion of the urethra which lies in front of the triangular ligament, between it and the bulb, the urine escapes into the cellular tissue of the perineum, and proceeds forwards and upwards underneath the dartos into the scrotum, its passage being marked by a red, erysipelatous blush of the surface, and by enormous tumefaction.

The prognosis of urethral infiltration is seldom flattering, though apparently the most desperate cases occasionally recover. The first, and, in fact, almost the only thing to be done, in the early stage of the affection, is to make large and dependent incisions, to afford vent to the pent-up and irritating fluids. A gum-elastic catheter should then be introduced into the bladder, and be allowed to remain there during the cure. The best local applications, after the parts have been properly divided, are warm fomentations of acetate of lead and opium, hops, or poppy heads. When the sloughing process has fairly begun, the fomentations may be advantageously superseded by emollient poultices, with the addition of yeast, port wine, nitric acid, or chloride of soda.

## URETHRAL ABSCESS.

Abscesses, to which the term urinary is usually applied, are liable to form in the cellular tissue round the urethra, leading, if improperly managed, to fistules and other mischief. Their ordinary site is the perineum, between the bulb of the urethra and the anus. A very common situation also is the upper part of the perineum, just behind the junction of the cavernous bodies of the penis, and, consequently, at the inferior portion of the scrotum. The next most frequent point is the scrotum itself, and, lastly, the under surface of the penis. Urethral abscesses are generally small and circumscribed.

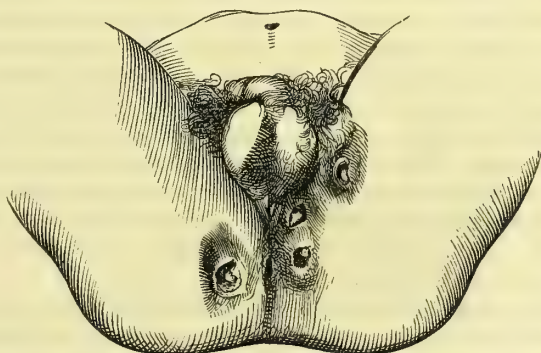
The exciting *causes* of this lesion are various. The most common, perhaps, is the existence of a tight, organic stricture of the urethra, attended with attenuation and dilatation of the tube immediately posterior to it. During a violent effort at micturition, the tube gives way behind the seat of the obstruction, sending the urine abroad into the connective tissues. A few drops thus effused are often sufficient to cause an immense abscess, accompanied by great suffering, both local and constitutional.

The *treatment* of urinary abscesses is sufficiently simple. The anti-phlogistic regimen, rest, recumbency, leeching, and fomentations, will limit the morbid action; while an early external incision will prevent the diffusion of the matter and the urine. When the sac has been emptied, and the accompanying inflammation has, in a great measure, disappeared, a catheter should be retained in the bladder, to prevent the escape of its contents by the abnormal orifices, the edges of which are to be touched, from time to time, with nitrate of silver, to promote cicatrization.

## URETHRAL FISTULE.

The most common site of urethral fistule (fig. 497) is that portion of the tube which corresponds with the perineum and the scrotum; the disease sometimes exists farther back, and, on the other hand, cases occur in which it is found near the anterior orifice.

Fig. 497.



Urinary fistules.



The abnormal channel, which may be single or multiple, long or short, is originally merely a sinus, or tubular ulcer, which soon becomes covered by granulations, and ultimately lined by an adventitious membrane.

The immediate *cause* of this affection is a solution of continuity of the mucous membrane, produced by ulceration, abscess, gangrene, or laceration, and followed by an escape of urine into the connecting cellular tissue. Here, acting as a powerful irritant, the fluid speedily excites inflammation, which soon terminates in suppuration, or, it may be, in the death of the affected parts. When the matter is evacuated, or the slough detached, the urine issues at the accidental opening, which now constitutes, in the true sense of the term, a fistule.

The efficient causes of urethral fistule are various. The most frequent, undoubtedly, is stricture, attended with dilatation of the tube behind the seat of obstruction; but it may also result from ill-managed attempts to pass instruments, from the protracted sojourn of catheters and bougies, gonorrhœa, retention of urine, external violence, and the operation of lithotomy.

The *diagnosis* of this disease is usually easy. An opening exists in some portion or other of the urethra, transmitting a urinous fluid, either in drops, in jets, or in a continuous stream synchronous with the act of micturition. A probe of small size, introduced into the external orifice, readily enters the urethra, provided the abnormal passage is not very narrow, oblique, angular, or sinuous.

The *treatment* of this affection, although obvious enough, is not always easy. The first thing to be done is to seek for, and, if possible, to remove, the exciting cause. In most cases this will be found to be a stricture, probably of long standing. Having already, in a previous page, spoken at length of the character and treatment of this affection, it is not necessary to refer to the subject here, any farther than to observe that, when the disease upon which the fistule depends is removed, the abnormal track ordinarily closes of its own accord. In general, it will be best to use a silver catheter, rather over than under the usual size, to be permanently retained, unless it should prove a source of decided suffering. Conducted upon this principle, the treatment rarely fails in the more mild and uncomplicated forms of the malady. It sometimes, however, happens, after all obstruction in the urethra has been removed, that the fistule manifests no disposition to heal, but remains pervious to the urine. The occurrence may be owing to various circumstances, which should be carefully sought, and, if practicable, removed. Very often the difficulty depends upon a callous condition of the parts, preventing the edges of the sinus from coming in contact. When this is the case, the object should be to destroy the secreting surface, and to promote the granulating process by stimulants and escharotics, especially the nitrate of silver. In rebellious cases recourse may be had to the heated wire, or to a probe dipped in nitric acid or the acid nitrate of mercury.

When the fistule is obstinate and protracted; when its internal orifice is uncommonly large, or when there are several openings of this kind; or, finally, when it depends upon an old stricture so firm, narrow,

and extensive that it cannot be destroyed in the ordinary manner, the only course left is to lay the parts open by an external incision, and heal them over the silver catheter.

When the fistule involves the spongy portion of the urethra, and has been caused by chancre, or external injury, attended with loss of substance, it may be necessary to have recourse to suture. The one usually employed is the twisted, made with short, slender needles, placed not more than a line and a half apart. The principal objection against the employment of the suture, in any form, for the relief of this affection, is its liability to tear itself out before the completion of the adhesive process, in consequence of the morbid erections. To guard against these erections, recourse should be had to anodyne enemata, or suppositories of opium and camphor, and to the application of pounded ice to the perineum. Excision has sometimes been practised with advantage.

When there is considerable loss of substance, *urethroplasty* may become necessary, the requisite amount of material being borrowed from the neighborhood and carefully adapted to the edges of the opening, previously refreshed with the knife. The operation, however, generally signally fails, whatever care may be taken in its execution, owing to the difficulty of preventing the contact of the urine. In order to guard against this, it has been proposed, after the edges of the fistule have been properly pared, to dissect up a large cutaneous flap on each side, and to unite them by suture along the middle line, over a piece of India-rubber, as exhibited in fig. 498. Or, instead of this, the integument may be dissected up subcutaneously (fig. 499), as recommended

Fig. 498.

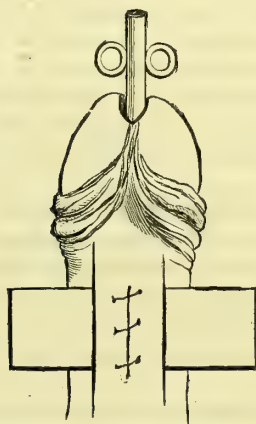
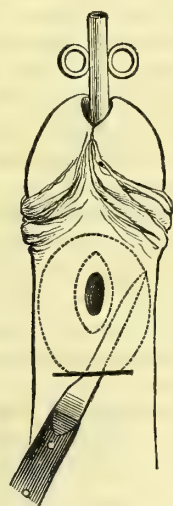


Fig. 499.



by Nélaton, and successfully practised by Erichsen. Whatever procedure be adopted, a medium-sized catheter should be retained in the bladder until the adhesion is completed, the urine being voided at

stated periods, while gentle pressure is made below the seat of the fistule, in order to prevent the fluid from passing by the side of the instrument.

#### FALSE PASSAGES.

A false passage is an artificial canal communicating with the urethra, and generally produced by the injudicious use of instruments. All

Fig. 500.



Stricture of the urethra, with false passage; enlargement of the prostate gland, and hypertrophy of the bladder.

portions of the canal are subject to it, but it is most frequent in the membranous and prostatic. The lesion is well seen in the annexed cut (fig. 500), from a preparation in my cabinet.

The artificial route is commonly situated at the inferior surface of the tube, chiefly because when an instrument is attempted to be introduced into the bladder, its point is almost always pressed in this direction, which also presents the greatest number of natural obstacles to its easy passage. The new channel, which is usually single, varies in length from a few lines to several inches, and may occur either as a cul-de-sac or as a distinct canal, the distal extremity opening into the urethra, or, perhaps, as occasionally happens, into the bladder, or even the rectum.

The *effects* of a false passage vary according to circumstances. When it consists of a mere cul-de-sac, little or no harm generally results; but when the route exists in the vicinity of the bladder, especially if it communicates with this reservoir, the danger may be very great, for it may then give rise to infiltration, abscess, and gangrene. When it extends into the rectum, or the rectum and bladder, a permanent fistule may follow.

The formation of false passages is seldom indicated by any reliable *symptoms*. The most common are hemorrhage, pain, and a feeling of laceration; but if these be examined, it will be found that they are of no value whatever as diagnostics. How, then, is the lesion to be determined? Is any confidence to be placed in the observation of the surgeon? The only circumstances worthy of notice, as far as he is concerned, are, first, a peculiar grating sensation communicated to his



hand while engaged in operating upon the urethra; secondly, a sudden slipping of the instrument from its position, or a feeling as if something had given way; and, thirdly, a deviation of the instrument from the normal direction of the canal.

The *treatment* of false passages must be conducted on general principles. Hemorrhage must be arrested, pain allayed, and further irritation by the use of instruments prevented. Rest in the recumbent posture, light diet, purgatives, antimonials, leeches, fomentations, and the warm hip-bath will, in general, put a speedy stop to the local inflammation. Urinary infiltration is a rare occurrence, owing to the fact that the water, flowing in a direction opposite to that of the artificial opening, is unable to insinuate itself into it.

#### HETEROLOGOUS FORMATIONS.

The urethra, like the urinary bladder, is liable to the heterologous formations, as scirrhous, encephaloid, and tubercle. These affections, however, are extremely rare, especially as independent deposits, and their occurrence here is interesting rather in a pathological than a practical point of view. Of colloid and melanosis of this tube, we are entirely ignorant.

There are no symptoms by which, in either sex, carcinoma of the urethra can be distinguished from other affections. All treatment, except with a view to palliation, is futile. Should retention of urine occur, the morbid growth must be perforated with the catheter, or, when this is impracticable, the urethra must be laid open behind the tumor.

#### SECT. III.—DISEASES AND INJURIES OF THE PROSTATE GLAND.

The prostate gland, from the peculiarity of its situation, and its intimate connection with the bladder, the urethra, and the seminal vesicles, is constantly exposed to inconvenience and hardship, rendering it liable to various diseases; but, until the age of puberty, it has merely a rudimentary existence, and is, therefore, seldom affected in any way. After its functional activity, however, is fully awakened, it becomes more liable to disorder, and this tendency may be said steadily to increase as we advance in life.

The affections of the prostate may conveniently be arranged under the following heads: 1. Inflammation. 2. Suppuration and abscess. 3. Ulceration. 4. Hypertrophy. 5. Atrophy. 6. Heterologous formations. 7. Cystic disease. 8. Hemorrhage. 9. Calculi.

##### 1. ACUTE PROSTATITIS.

Acute inflammation of the prostate seldom exists as a primary affection, except when it is produced by direct injury. Idiopathically considered, it is most frequently met with in middle life, when the genital

organs are in their full vigor and in active sympathy with the rest of the system.

The characteristic *symptoms* are deep-seated, burning, and throbbing pain, gradually increasing difficulty in micturition, excessive scalding of the urethra as the urine flows over its mucous surface, a feeling of weight and stuffing in the rectum, constant tenesmus and desire to relieve the bladder and bowels, and a flattened form of the feces. If the finger be inserted into the rectum, the gland can be distinctly felt as a solid, painful tumor, sometimes almost sufficiently large to close the tube and seriously impede defecation. If the surgeon attempt to introduce a catheter into the bladder, he will find it exceedingly difficult, if not impracticable, unless he possesses more than ordinary skill in the management of the instrument. The local symptoms are generally accompanied by well-marked constitutional disturbance.

The most common exciting *causes* of acute prostatitis, are gonorrhœa, stricture of the urethra, venereal excesses, horseback exercise, external injury, and suppression of the cutaneous perspiration.

Although this disease is seldom dangerous to life, or disposed to run into suppuration, yet, in view of the great suffering which it induces, the *treatment* should always be of the most prompt and decisive character. Active depletion by the lancet and by leeches to the perineum and anus is always indicated, especially if the patient be robust, and should be practised without delay. If the bowels are costive, the venesection is immediately followed by a brisk cathartic, consisting of castor oil, or calomel and jalap, assisted, if necessary, by enemata. Fever is combated by the antimonial and saline mixture, in union with morphia and aconite, in the hope of allaying pain and depressing the heart's action. Relaxation of the skin is promoted by hot steam, conveyed to the body by means of a tube connected with the spout of a tea-kettle. The genital organs, hypogastrium, and perineum, should be enveloped in flannel cloths, wrung out of warm water and laudanum; and the pain and straining, which so commonly attend the disease, are generally promptly relieved by a full anodyne injection.

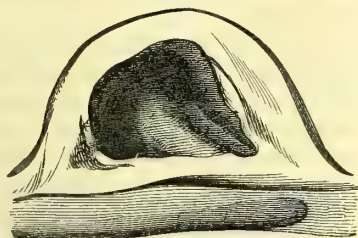
The condition of the bladder is early attended to, retention of urine being promptly relieved with the catheter, handled with the greatest gentleness. Absolute recumbency is indispensable throughout the whole treatment; the diet must be of the blandest character, and drink of every description is abstained from in order to secure repose to the inflamed parts.

## 2. ABSCESS OF THE PROSTATE.

Acute inflammation of the prostate occasionally terminates in abscess. When this event is about to take place, there is an increase of all the previous symptoms, both local and constitutional. The pain is exceedingly violent, and is soon followed by complete retention of urine. Severe rigors, alternating with flushes of heat, are present, and the patient soon becomes delirious. An examination by the rectum often detects fluctuation. When the abscess tends towards the perineum, its advent is always preceded by marked swelling, an erysipelatous blush of

the surface, and an œdematous condition of the subcutaneous cellular tissue.

The annexed cut (fig. 501) affords a good illustration of an abscess of the prostate, as it occurred in an elderly man, who died from the effects of the disease, ten days after the commencement of the first symptoms. The pus was of a thick, cream-like consistence, and of a yellowish color, its quantity being a little over a teaspoonful. The inflammation had deeply involved the neck of the bladder.



Abscess of the prostate.

Abscess of the prostate is generally regarded as a dangerous affection. When recovery occurs, the patient may be troubled with a fistulous communication with the rectum, urethra, perineum, or bladder.

In the *treatment* of this affection, two important indications are presented; first, to limit the suppuration, and, secondly, to afford a speedy outlet to the effused fluid. To fulfil the first, prompt recourse must be had to depletion, provided this has not already been carried sufficiently far, to antimonials, diaphoretics, anodynes, and emollient applications. Leeches should be applied to the perineum, and hypogastrium.

In order to fulfil the second indication, the rule is to anticipate nature by an artificial opening. If the abscess points towards the perineum, an incision should be made in the most prominent part of the swelling, with a long, straight, narrow pointed bistoury, care being taken to avoid, on the one hand, the rectum, and on the other, the bladder.

When the abscess points in the rectum, it may readily be reached with a long, curved trocar. For some days after the operation the lower bowel should be kept as quiescent as possible.

When the abscess bulges inwards towards the urethra and the neck of the bladder it may be punctured with a common silver catheter; or, instead of this, a sound with a conical beak and a small curve may be used. When the abscess is not yet completely matured, and delay would be improper, the operation may be executed with the lancetted stylet. The urine should be frequently drawn off with the catheter.

### 3. ULCERATION OF THE PROSTATE.

This affection is of infrequent occurrence and of difficult recognition. It is induced by various causes, of which the principal are wounds, contusions, lacerations, and the presence of calculous concretions in the substance of the organ.

The *symptoms* are such as indicate the existence of chronic disease of the prostate and of the neck of the bladder. Perhaps the most reliable circumstances, in a diagnostic point of view, are, the absence of vesical calculi, long continued suffering, as a sense of weight, aching, and throbbing at the neck of the bladder, a constant secretion of thick, glairy mucus, a frequent desire to micturate, and an occasional dis-



charge of blood, with excessive burning during the accumulation of the urine.

The *treatment* of this grave affection is altogether unsatisfactory and empirical. Attention must be paid to the general health; the patient should avoid exercise and the erect posture; the bladder should be daily washed out with tepid water, either simple or medicated; and the affected surfaces should be lightly touched twice a week with a solution of nitrate of silver, as ten grains to the ounce of water, applied with a piece of soft sponge, projected from a silver canula. The best internal remedies are, balsam of copaiba, cubebs, and spirits of turpentine, largely diluted with demulcent fluids. Anodynes must be freely used both by the mouth and rectum.

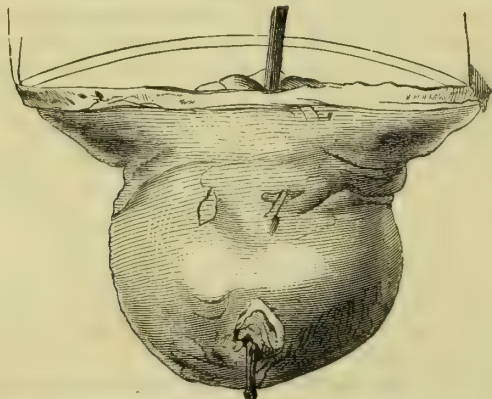
#### 4. HYPERTROPHY OF THE PROSTATE.

Hypertrophy of the prostate is an augmentation of its volume, produced by increased nutrition. There are several forms of it, but the most common is that to which the term *senile* has been applied, from its being a frequent accompaniment of old age.

Hypertrophy may occur in any part of the organ. Most commonly it affects the entire gland, though not uniformly. Occasionally it is almost exclusively confined to the third lobe, and that too, perhaps, when the enlargement is so great as to cause retention of urine, and, ultimately, the patient's death.

The hypertrophy exists in various degrees, from the slightest increase of the natural volume of the prostate to the dimensions of a pullet's egg, a walnut, or a medium-sized orange. In rare cases, it may exceed the latter dimensions. The greatest increase of volume usually occurs in the long axis of the organ, in consequence, no doubt, of

Fig. 502.

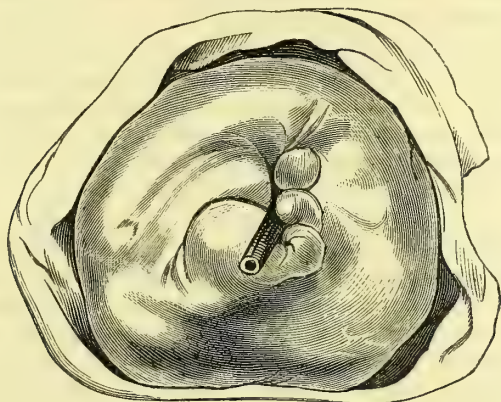


Hypertrophy of both lobes of the prostate.

a want of resistance in this direction. The annexed drawing (fig. 502), from a specimen in the collection of Dr. Mott, affords a good illustration of what may be called uniform hypertrophy of both lobes

of the prostate. Fig. 503, from one of my preparations, exhibits great enlargement of the gland in its antero-posterior diameter, with a mammillated appearance at its posterior extremity, seemingly dependent upon an irregular condition of the middle lobe.

Fig. 503.



Hypertrophy of the prostate.

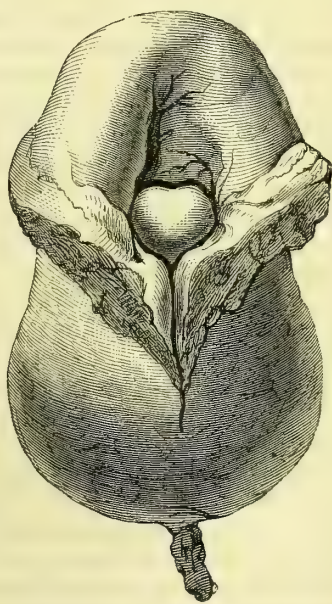
When one lateral lobe is more enlarged than the other, the more bulky one frequently encroaches upon the smaller, and thus produces a lateral curvature in the neck of the bladder and the commencement of the urethra.

Whatever may be the shape of the abnormal masses, or the direction in which the hypertrophy occurs, their surfaces, both external and internal, are either perfectly smooth, or they are irregular, knotty, and even lobulated.

When the middle lobe is hypertrophied, it generally forms a kind of mammillary process, more or less vertical in its position, and ranging in size from that of the female nipple to that of an almond (fig. 504). The apex of the tumor is free and rounded, while the base is immovably fixed, resting as it were upon the posterior extremity of each lateral mass. Its position is usually median, but it projects towards the bladder, drawing up the prostatic portion of the urethra and elongating the verumontanum.

The *consistence* of a hypertrophied prostate is liable to considerable diversity, and occurs under two very opposite forms, the hard and the soft. In the

Fig. 504.



Hypertrophy of the prostate, with mammillary enlargement of the middle lobe.

first, which is the more frequent, the induration varies from the slightest increase of the natural consistence to the firmness of fibrous tissue. Interspersed through its substance are numerous granulations. In the soft variety, the enlargement proceeds in a more uniform manner, and attains, as a general rule, a greater magnitude than in the hard. The affected tissues are more or less elastic, and yield readily under the pressure of the finger. The granulations are larger and more conspicuous than in the first variety. The nature of these granulations is not well ascertained. It is highly probable, however, that they are nothing but the terminal follicles of the prostate in a state of enlargement and partial occlusion.

Hypertrophy is always produced under the influence of *causes* which act in a slow and permanent manner. Whatever, therefore, has a tendency to keep up habitual engorgement in the organ may be considered as being capable of producing the affection. Augmented action necessarily occasions an augmented afflux of blood, and a corresponding increase of nutrition. Diminished action has a reverse effect. Amongst the more frequently enumerated causes of this disease, are excessive venery, stricture of the urethra, disease of the bladder, horseback exercise, gonorrhœa, and the employment of stimulating diuretics; but, in general, the influence of these causes is rather apparent than real. They are, no doubt, all capable of inducing the disease; but, on the other hand, it is equally certain that they are often accused when they are entirely innocent. Some of the very worst cases of hypertrophy of the prostate occur in old men who have led the chastest lives, who have not rode on horseback for forty or fifty years, and who have never had the slightest disease of any kind of the urethra.

Hypertrophy of the prostate is emphatically a disease of old age. The *senile* form of the lesion rarely takes place, at least not in any considerable degree, before the fiftieth year; slight manifestations of it are occasionally met with at forty-five, and, indeed, even at forty, but this is exceedingly rare, and constitutes an exception to an important general law. Hypertrophy, not the result of old age, may occur at any period of life, under the influence of inflammatory excitement and vascular engorgement.

Irritation of the neck of the bladder, and a frequent desire to pass the urine, are the *symptoms* which generally first attract the attention of the patient. By degrees, the distress at the neck of the bladder becomes more constant, as well as more severe, and there is not only a frequent desire to void the urine, but great difficulty in starting it. Slight pain is felt along the urethra, accompanied by a burning, smarting, or scalding sensation in the head of the penis, and a copious discharge of prostatic fluid. The rectum never feels entirely empty, even after the most thorough purgation, but all the time as if it contained a lump or ball, and the feces are often passed in a flattened form. At night the patient is occasionally disturbed by an involuntary discharge of seminal fluid. As the disease advances, the symptoms become more aggravated, though they are still essentially the same in character. The general health, which until now was, perhaps, tolerably good, slowly declines.



The urine, at first perfectly clear, and, to all appearance, natural, becomes gradually changed in its properties, and sometimes even in its quantity. It is generally thick, fetid, acrid, and highly alkaline, depositing, on standing, a great abundance of thick, ropy mucus, often streaked with phosphatic matter. The fluid is soon decomposed, if, indeed, it is not so before it is voided, and then always exhales a strong ammoniacal odor. Gradually micturition becomes more and more difficult, and, at last, after months and perhaps years of the most cruel suffering, the urine is either retained, or has to be drawn off constantly with the catheter.

Hypertrophy is a disease almost peculiar to advanced life; hence, when an individual who has attained the age of fifty, fifty-five, or sixty, is affected with the train of symptoms above enumerated, the presumption is strong that the case is one of chronic enlargement of this body, and nothing else. The affections with which it is most liable to be confounded are stricture of the urethra, urinary calculi, catarrh of the bladder, and stricture of the rectum. All, however, that is necessary, in any case, to determine the diagnosis, is a digital examination of the rectum. For this purpose, the left index-finger, gently inserted into the gut, is moved about in different directions, first upwards along the median line, and then successively towards each side, noting, as it does so, the impression made upon the finger by the affected gland. In general, it will be found, as before stated, to be larger on one side than the other, and to feel like a hard, solid body, the surface of which is either smooth and uniform, or irregularly knobby.

The *effects* of hypertrophy of this gland upon other parts of the urinary apparatus are frequently very distressing. The organ which is most liable to suffer is the bladder, the muscular coat of which becomes greatly thickened, and fasciculated from the constant obstacle to the evacuation of the urine. For the same reason, the mucous membrane is always chronically inflamed, and sometimes mammillated, ulcerated, or protruded across the intervals between the enlarged muscular fibres. Another effect is the occasional formation of urinary calculi.

The urethra, during the progress of this disease, often undergoes important changes. These changes are exclusively limited to the prostatic portion of the urethra, which, in the more aggravated forms of the hypertrophy, is nearly always remarkably elongated. In enlargement of the middle lobe, the urethra is dragged up behind the pubic arch. Lateral curvature of the canal is occasionally met with, being generally dependent on an unequal enlargement of the inner edges of the lateral lobes.

The ureters are seldom sound. The most common lesion is dilatation of their caliber, with irregular thickening or attenuation of their walls.

The kidneys often sympathize in the disorganization of the prostate, or, rather, in the changes which it induces in the bladder and the ureters. As a natural consequence, they soon become inflamed, and more or less altered in their size, shape, and structure.

The seminal vesicles are liable to suffer, and it rarely happens that

the rectum is not implicated. Prolapse and hemorrhoids are not uncommon.

In entering upon the *treatment* of this affection, we have to lament the impotency of our art, and the limited nature of our therapeutic resources. These remarks are particularly true of the senile form of the complaint, which hardly ever yields to any mode of management, however judiciously devised or perseveringly employed.

General depletion is very rarely indicated in this variety of prostatic disease. If, however, the patient be plethoric, the enlargement considerable, and the sympathetic reaction great, no remedy will be so likely to afford prompt and decided relief as a full bleeding at the arm. The detraction of blood should always, in the more aggravated varieties of the complaint, be speedily followed by the use of the antimonial and saline mixture, in the hope of subduing the action of the heart, unlocking the secretions, and clearing out the bowels. All irritating, heating, or griping cathartics, must here, as in most other affections of the prostate, be proscribed. At the same time, it must be borne in mind that an overloaded state of the bowels is never permissible. Sulphate of magnesia, or jalap and bitartrate of potassa, by rendering the feces soft and watery, are particularly well adapted to cases of such a nature. When manifest disorder of the biliary secretion exists, a few grains of calomel will generally prove serviceable. The food should be perfectly plain, easily digestible, unirritating, and well masticated. Condiments, wine, brandy, and fermented drinks are carefully avoided. Unless strict attention be paid to these rules, no reasonable hope even of temporary amendment can be indulged. All exciting causes of the disease are to be carefully avoided. Above all, it is necessary that the patient should abstain from horseback exercise, and from sexual intercourse.

Repose in the horizontal posture is hardly less important here than it is in the more acute affections of the prostate. By this remark it is not, of course, meant that the patient shall confine himself constantly to his bed, and avoid all exercise; on the contrary, he should not neglect, whenever the weather is pleasant, to move about for a few hours every day in the open air, either on foot or in an easy carriage. When in the house, he may lie upon a lounge, or recline upon an easy chair, with a movable back.

For the purpose of acting directly upon the gland, and thereby lessening its volume, various remedies have been proposed. Among the more important of these are iodine and its different combinations, cicuta, mercury, hydrochlorate of ammonia, local depletion, and counter-irritation by issue, seton, blister, and tartar-emetic pustulation. Of these remedies it may be observed, in general terms, that their efficacy has been fully tested by different observers, and that they are all to be regarded merely in the light of palliatives.

*Iodine* is more especially indicated in those cases in which the hypertrophy depends upon a syphilitic taint of the system, or an effusion of lymph, and which are characterized by a rapid progress. The best form of exhibition is Lugol's solution, or the iodide of potassium, either alone or in union with iodide of iron and a minute quantity of bichlo-

ride of mercury. This remedy should be continued for a length of time, with occasional intermissions for a few days, to afford the stomach a short respite.

*Cicuta* has been a favorite remedy in the treatment of this affection. Administered in combination with other articles, it may occasionally prove beneficial.

I have not found that *mercury*, exhibited with a view to its constitutional effects, is capable of exciting any particular influence over this disease. Nevertheless, in obstinate cases, where other means have failed to afford relief, I should not hesitate to resort to it. Ptyalism should not be produced. From three to five grains of blue mass, with one grain of extract of *cicuta*, should be given three times daily, until the gums are slightly touched. The medicine is then to be discontinued until the primary impression begins to subside, when it may again be resumed and exhibited as before. When an alterant plan of treatment is required, as, for example, when the enlargement has been produced by a syphilitic taint of the system, the mercury may advantageously be exhibited in union with iodide of potassium. Under such circumstances, the bichloride, cyanuret, or biniodide are preferable to calomel and blue mass. Donovan's solution would also be worthy of trial.

*Hydrochlorate of ammonia* has long been familiar to the profession as a valuable remedy for the removal of visceral induration and enlargement. It may be exhibited, either alone or in combination with a minute portion of tartrate of antimony and potassa, in the dose of ten, fifteen, or twenty grains several times a day.

There are few remedies which afford greater relief in this affection, whether the result of inflammatory action or of senile decay, than *leeching*. The blood may be taken either from the anterior wall of the rectum, or from the perineum and inside of the thighs. The plan which I usually adopt is to apply from four to six leeches to the perineum every fourth or fifth day.

*Counter irritation*, by issue, seton, blister, and pustulation with tartar-emetic ointment, is a valuable adjuvant in the treatment of chronic enlargement of the prostate. The choice of the remedy, and the place to which it is applied, must be regulated by circumstances. My favorite practice is to insert a small seton into the perineum.

*Iodide of potassium*, exhibited by the rectum, has been highly lauded in the treatment of this affection. The form in which it is administered is that of a suppository, consisting of from three to five grains of the salt, with five grains of the extract of *cicuta*, and the same quantity of the extract of *hyoscyamus*, introduced into the bowel night and morning. The strength of the remedies is gradually increased to ten grains. The treatment is continued for several months, and is aided by the daily use of the bougie, anointed with iodine ointment, composed of five grains of the salt to one drachm of simple cerate. The urine is drawn off every twelve hours with the catheter.

To allay the irritation of the bladder, which so frequently attends this disease, the warm bath, fomentations, opiate suppositories, and anodyne injections are necessary.



Finally, the patient must pay particular attention to the time and manner in which he voids his urine. Micturition should not, on an average, be performed oftener than once every four hours. Moreover, he must avoid straining during the operation. To prevent accumulation of water, it frequently becomes necessary to draw it off at stated periods with the catheter.

Injection of the bladder, as advised under the head of catarrh of the organ, often produces great relief, by dislodging the thick, ropy, and offensive mucus which so often collects in the *bas-fond* of the bladder.

As means calculated to produce a direct impression upon this organ, mention may be made here of cauterization, excision, incision, and crushing.

It is not easy to comprehend how *cauterization* acts in bringing about a diminution of the volume of a hypertrophied prostate, when it is remembered that it can only be made to the mucous membrane of the urethra. The cauterization, if deemed advisable, is performed with a suitable instrument, as that delineated under the head of stricture of the urethra. It should not be repeated oftener than once a week, and any irritation following it should be combated by demulcent drinks, anodynes, recumbency, and the warm bath.

*Scarification* of the affected gland has occasionally been practised, and sometimes apparently with advantage. The operation, which gives rise to little or no pain, is performed with a curved lancetted stylet, similar to that used for dividing strictures of the urethra. It may be repeated about every fourth day, and is particularly worthy of trial when there is an unusual degree of irritability of the prostate.

*Excision* of the prostate has been recommended. It does not, however, appear that any one has really ever had the hardihood or folly to perform it. Excision of the middle lobe would be less objectionable.

Another operation for the relief of chronic enlargement of the prostate is *incision*. It is founded upon the fact that the operation of lithotomy, performed upon persons affected with this complaint, has occasionally relieved them of it. Of the propriety and utility of this process, I am unable to speak from personal observation, but, judging from the results recorded by others, I am disposed to place little confidence in it.

The operation of *crushing* is applicable only to the middle lobe of the prostate. It was evidently originally suggested by the operation of lithotripsy, of which, in fact, it is merely a modification. It consists in seizing hold of the enlarged body with the lithotrite, and grinding, squeezing, pressing, or mashing it into a soft, pulpy substance, which is detached partly by the instrument, and partly by the sloughing process, being afterwards discharged with the urine. The proceeding is best adapted to those cases in which the middle lobe, adhering by a small pedicle, rises up behind the mouth of the bladder in the form of a narrow, elongated valve. The operation is not attended with much pain, but it is liable to be followed by hemorrhage, severe inflammation, and even death, on which account it ought to be performed with great caution.

*Perforation* of the middle lobe of the prostate has been proposed

when this body forms an insuperable barrier to the evacuation of the urine, whether by the natural efforts or by artificial means. The operation may be performed with a large trocar, inclosed in a silver canula, and curved like an ordinary catheter. The instrument is introduced in the usual manner, as far as the seat of the obstruction, where it is firmly held until the trocar is pushed across the base of the swelling into the bladder. The want of resistance will indicate that the transfixion has been completed. The trocar is then withdrawn, and the canula left in the bladder. In a few days this is also removed, and a large catheter substituted. In this manner the treatment is conducted until the new canal has become lined by a mucous membrane, when the occasional passage of the catheter will suffice to prevent occlusion. In performing this operation, great care must be taken to keep the instrument in the middle line, and at a proper distance, on the one hand, from the arch of the pubes, and, on the other, from the rectum.

### 5. ATROPHY.

The prostate, like other organs, is liable to atrophy. The affection sometimes exists as an effect of senile decay, but more frequently it is the result of mechanical compression, and structural disease. The senile form of atrophy is extremely rare, and seldom exists as a pure, uncomplicated affection. The extent of the wasting varies, being sometimes limited to a portion of the gland, while, at other times, it involves its whole body.

### 6. HETEROLOGOUS FORMATIONS.

The heterologous formations of the prostate are extremely uncommon. The most frequent, undoubtedly, is encephaloid, but even this is exceedingly rare. It has hitherto been observed chiefly in advanced life, though no period seems to be exempt from it.

There are no signs by which encephaloid can be distinguished, with any clearness, from some of the other affections to which this body is liable. The most reliable evidences are a discharge of blood with the urine, the occasional expulsion of cerebriiform substance or organized clots, the frequent desire to pass water, and the ability to feel the enlarged gland through the rectum. No kind of treatment, either local or general, is of any service.

Of *scirrhus*, colloid, and melanosis of this gland, nothing is known. Their occurrence is extremely rare, and, excepting the latter, I have never met with them. In the case referred to, the black deposit existed in the bladder, and in almost every other organ of the body, without any suspicion of its presence, during life, in the urinary apparatus. The patient was a man, fifty-eight years of age.

The prostate gland is occasionally the seat of *tubercles*. The affection, however, is also extremely rare, and is usually associated with similar deposits in the seminal vesicles, urinary bladder, kidneys, testicles, and other organs. The disease furnishes no characteristic symptoms, and every attempt to treat it upon scientific principles must prove unavailing. When its existence is suspected, iodine may be administered internally, and counter-irritation applied to the perineum.

## 7. CYSTIC DISEASE.

Cysts occasionally exist in the prostate, but their occurrence is extremely rare. They vary very much in size and number, but are usually quite small. Their contents are transparent, fluid, and of a serous character. Their mode of origin has not been determined. They are, probably, merely dilated and closed follicles, or expanded and closed excretory ducts. Old persons are most obnoxious to them.

## 8. FIBROUS TUMORS.

Fibrous tumors of the prostate vary in their volume from that of a pea to that of a small almond; they are of a spherical, or ovoidal form, of a firm, dense consistence, and of a dull, grayish color. They are usually situated on the outer surface of the gland, but occasionally they project inwards, so as to encroach upon the urethra, and neck of the bladder. They commonly grow from a broad base, and a section of them displays a grayish, drab-colored tissue, of a tough, inelastic character, having little moisture, and but few vessels. Their existence may be suspected, but cannot positively be affirmed during life.

## 9. HEMORRHAGE.

The prostate gland is liable to hemorrhage, varying in degree from a few drops to several ounces. The occurrence, however, is very rare, and is chiefly met with in aged subjects, in consequence of the forcible use of instruments. Sometimes the most gentle catheterism will be followed by a smart flow of blood. The irritation of a calculus may also give rise to it.

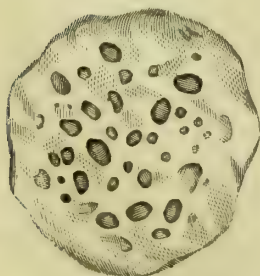
The prognosis is favorable or otherwise, according to the cause of the hemorrhage; as, for example, whether it is simple or traumatic, or dependent on ulceration of the gland, or the presence of malignant disease. The treatment is to be conducted upon the same principles as that of hemorrhage of the urinary passages generally.

## 10. CALCULI OF THE PROSTATE.

The prostate, like the bladder and the kidney, is liable to the formation of calculi (fig. 505), which generally become a source of severe suffering, imperiously demanding surgical and other interference. They are entirely different, both in their structure and composition, from vesical concretions, and appear to be the result, at least in some instances, of disordered follicular secretion, dependent, in all probability, upon subacute or chronic irritation. Old persons are most prone to the formation of these concretions; they may, however, occur at almost any period of life.

The number of concretions is extremely va-

Fig. 505.



Prostatic calculi.



riable; sometimes there is only one, while, at other times, there are so many as to render it difficult to count them. Their volume is generally in proportion to their number. Composed exclusively of phosphate of lime, they are of a spherical or ovoidal shape, of a firm consistence, and of a grayish, whitish, or brownish color. From a careful examination of their situation, in different stages of their development, I am led to believe that they are originally formed in the follicles and ducts of the prostate, from which they either escape, or they remain, and gradually destroy its substance.

There is no uniformity in the *effects* produced by these bodies. When small, they seldom cause much uneasiness, sometimes, indeed, not the slightest. At times, however, they are productive of great inconvenience, if not of excessive suffering. One of the most common occurrences is a dull, aching, wandering pain, with a sense of uneasiness in the perineum and neck of the bladder. The general symptoms do not differ materially from those which accompany stone in the bladder.

The *diagnosis* of this affection is by no means always easy. When the finger is introduced into the rectum, the prostate being at the same time pressed backwards with a large sound, the concretions may often be felt as so many hard, irregular projections, the position of which remains unchanged by any force that can be applied to them. When a considerable number are collected together, as it were, in a nest, they impart to the finger the feel of a bag of marbles, of a mass of clotted blood, or of a bag of air. Another sign upon which great reliance is to be placed, is the circumstance that the concretions can be felt only in one particular spot, and that they are generally immovably fixed, or nearly so.

Prostatic calculi are usually associated with disease of the urinary apparatus, as stricture of the urethra, hypertrophy of the muscular coat of the bladder, vesical calculi, and disorganization of the ureters, and kidneys. The prostate itself is variously affected; generally, it is atrophied, and partially sacculated.

In the *treatment* of prostatic calculi, the general health must be attended to; and any complications that may exist must be met upon ordinary principles. To counteract the tendency to phosphatic deposits, the different acids, especially the nitric, must be put in requisition, either singly or combined with infusion of uva ursi and hops. Alkalies are also sometimes indicated.

The radical treatment, which, of course, is purely mechanical, must be regulated by circumstances. When the calculi project into the urethra, they sometimes admit of being detached with instruments, and pushed back into the bladder, or, an attempt may be made to extract them with Weiss' forceps. When they are encysted, or contained in a bag in the parenchymatous substance, the only way is to cut down to the organ upon a staff, as in the ordinary lateral operation of lithotomy; or, when this cannot be done, the median operation should be performed. Occasionally, the calculi lie in the cellular substance between the prostate and the rectum; and, when this is the case, an incision may be made through the bowel, previously well dilated with the speculum.

## CHAPTER XVI.

## DISEASES AND INJURIES OF THE MALE GENITAL ORGANS.

## SECT. I.—AFFECTIONS OF THE TESTICLE.

THE testicle is liable to inflammation, abscess, hypertrophy, atrophy, serous cysts, tuberculosis, encephaloid, scirrhus, melanosis, colloid, hydatids, and neuralgia.

1. *Orchitis*.—Inflammation of the testis, technically called orchitis, may be acute or chronic, idiopathic or traumatic, primary or consecutive. The acute form of the disease is seated principally in the epididymis, and is generally caused by gonorrhœa, the inflammation being transmitted from the urethra along the deferent duct. It may also be occasioned by external violence, great sexual excitement, the effects of cold, and by metastasis, as in mumps. During the existence of gonorrhœa, the most trifling circumstances, as the pressure of the pantaloons, exposure to wet, fatigue, and stimulating injections, will induce the disease. The epididymis, enlarged to twice or thrice its natural volume, is preternaturally firm, and the vaginal tunic is distended with turbid serum, intermixed with flakes of lymph. The testis itself

is comparatively little increased in size (fig. 506). The part is exquisitely tender, and intolerant of the slightest pressure; the pain is of a dull, heavy, aching character, and extends upwards in the course of the spermatic cord as far as the loins, where it is often very severe; the scrotum is hot, tense, red, and glistening; high fever is present, frequently accompanied by nausea and vomiting; and, if blood be drawn from the arm, it is usually found to be sizy and cupped. The discharge from the urethra is very much diminished, or entirely suspended, and the patient is often annoyed with nocturnal emissions, tinged with blood. In many cases great uneasiness is felt in the groin, abdomen, hip, perineum, and upper

Fig. 506.



Acute orchitis.

part of the thigh. When the epididymitis, as this affection is properly designated, follows gonorrhœa, it usually comes on about the end o

the third or the beginning of the fourth week of the attack of this disease, though it may occur much earlier, as well as much later. It often affects both glands, either simultaneously or successively.

The *treatment* is rigorously antiphlogistic. If the patient is young and plethoric, blood is taken freely from the arm; the bowels are evacuated with senna and Epsom salts, or calomel and jalap; antimony is given in small doses, to keep up nausea; the recumbent posture is observed; and the scrotum, suspended with a folded handkerchief, is diligently fomented with the lead and opium lotion. Cold applications, seldom agreeable to the patient, are often positively injurious. Blood may sometimes be abstracted advantageously by puncture from the veins of the scrotum, or by leeches from the groin, perineum, or inside of the thighs. As soon as the disease loses its acute character, which it usually does under this treatment in three or four days, the gums should be gently touched with mercury, and the affected part supported by compression, kept up with strips of adhesive plaster, about six lines in width, and eight inches in length. The strips are applied as in the annexed engraving (fig. 507), which explains the process much better than any description. The first is placed circularly round the cord, just above the epididymis, as tightly as it can be borne; the second slightly overlaps the first, the third the second, and so on until the whole tumor is enveloped down to its base, when five or six vertical strips complete the dressing.

The patient usually experiences some degree of pain during and immediately after the operation, and should this not subside in an hour or two the compression must be discontinued. The strapping requires to be renewed every twenty-four hours. The advantage of this treatment is that, while it rapidly subdues the disease, the patient is able to walk about and attend to business.

2. *Suppuration and Abscess.*—Orchitis does not often pass into suppuration, much less into abscess. When matter is about to form, all the symptoms become suddenly aggravated; rigors come on, often attended with slight delirium; and the part is so painful as to be intolerant of the slightest manipulation and pressure. The pus, being generally mixed with seminal fluid, is seldom of a healthy character; and, as it is confined by the albugineous coat, it is always a long time in reaching the surface. The abscess often breaks at several places, thus leaving unhealthy sores, which it is difficult to heal,

Fig. 507.

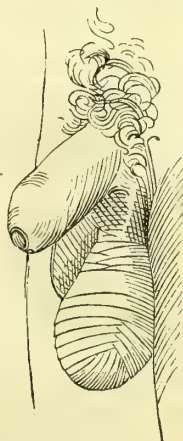
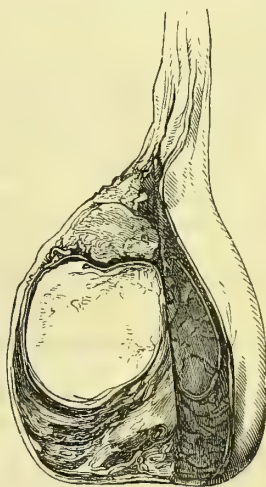


Fig. 508.



Abscess of the testicle.



and which not unfrequently lead to a total disorganization of the tubular structure. Suppuration of the testicle is most common in scrofulous subjects, and in persons affected with tertiary syphilis. The matter is sometimes encysted, as in fig. 508. When pus forms as a consequence of ordinary epididymitis, it is generally situated in the vaginal tunic, and not in the substance of the testicle.

The proper *treatment* consists in an early incision, or, rather, in a delicate puncture, especially when the fluid is situated in the substance of the testicle, the object being to save texture. The retention of pus in the parenchymatous tissue of the gland must carefully be guarded against, as being calculated to do immense harm by disorganizing the tubular structure.

When the matter is allowed to find a spontaneous outlet, the opening is very liable to become the seat of *fungus*, consisting of a

Fig. 509.



mass of tubular substance and unhealthy granulations, as seen in fig. 509, from one of my clinical cases. When the protrusion is small, or of recent standing, it may occasionally be successfully repressed by regular, systematic compression with adhesive strips; or, instead of this, the edges of the opening may be thoroughly pared, and approximated by several points of the twisted suture. In the more severe and intractable cases, the mass must be retrenched with the knife or scissors; this failing, castration must be performed, an operation which is the more proper, because the substance of the testicle is, under such circumstances, generally completely destroyed, as I have satisfied myself by dissection.

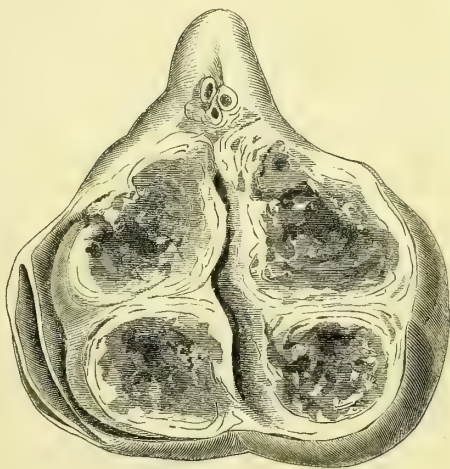
3. *Chronic Orchitis*.—Chronic inflammation of the testis may arise spontaneously, or succeed an acute attack. The most frequent exciting causes are gonorrhœa, stricture of the urethra, chronic cystitis, and hypertrophy of the prostate gland. The disease is characterized by induration and swelling, which, beginning in the epididymis, where they are always most conspicuous, gradually extend to the body of the testis, forming a tumor four or five times the normal bulk, free from pain, and so slow in its advances as to escape notice until it has produced serious structural changes. This circumstance, together with the irregular shape of the tumor, is sufficiently diagnostic of the nature of the affection. The hypertrophy, which may occur on both sides, is liable to be followed by suppuration of the parenchymatous structure, hydrocele of the vaginal sac, and thickening of the cord. In obstinate cases, a section of the tumor exhibits a dense, fibrous texture, of a reddish or brownish color, interspersed with small cells. It was to this form of the disease that the term *sarcocoele* was applied by the older surgeons.

The indications are to remove any exciting cause that may still be in operation, and to promote the absorption of the effused matter upon the presence of which the hypertrophy depends. To fulfil the latter, the patient is confined to his back, on light diet, and is slightly mercurialized. The best preparations for this purpose are calomel, blue

mass, and protiodide of mercury, guarded with a proper quantity of opium. The bowels are cleared out every other day with castor oil, sulphate of magnesia, or the black draught. Suspension of the scrotum is indispensable; and discutient lotions, tincture of iodine, and local depletion by leeches or punctures are important adjuvants. Ointments are usually hurtful. In some instances, I have derived great benefit from compression, applied as in acute epididymitis. If matter forms, it must be promptly evacuated; fungus is repressed by escharotics and the knife. Steady perseverance in this treatment for six or eight weeks is indispensable to a cure. Castration is unwarrantable, unless malignant action supervene, which is not probable.

4. *Fibrous and Cartilaginous Degeneration*.—The substance of the testicle, in consequence of protracted inflammation, occasionally undergoes the *fibrous* degeneration. The change probably begins in the internal cellular structure, which is gradually converted into white, grayish, or bluish filaments, narrow, dense, resisting, and interlaced in every conceivable manner. The new tissue interferes so much with the nutritive condition of the seminiferous tubes as to occasion, at first, a diminution in their size, and ultimately their entire destruction. When the transformation is complete, the organ is firm, solid, almost incompressible, and inelastic; it creaks under the knife, possesses very little moisture, and is nearly destitute of cellular substance. Small cysts, containing serous fluid, are occasionally interspersed through it, and specimens are observed in which there are tolerably large cavities filled with whitish, jelly-like matter. The tumor rarely exceeds the volume of a common sized orange. The vaginal and albugineous tunics often preserve their natural characters. The disease has no tendency to return after removal. The annexed sketch (fig. 510), from a preparation in my collection, conveys a good idea of the peculiar structure of this morbid growth.

Fig. 510.



The history of the case, the chronic course of the disease, the absence of pain, the freedom from lymphatic involvement, the integrity of the spermatic cord, and the great firmness of the tumor, readily serve to establish the diagnosis between this and other affections of the testicle.

When this disease is fully formed, the substance of the testicle being annihilated, the only suitable remedy is extirpation. In its earlier stages, its progress may sometimes be stayed by sorbefacient applications, aided by occasional leeching and strapping, and by gentle, but persistent ptyalism.

Masses of fibro-cartilage are occasionally, though rarely, found in the testicle, either alone, or, as is more commonly the case, in union with other morbid products. They may be situated between the vaginal and albugineous coats, or in the tubular substance of the organ, which, when they are large or numerous, may be in great measure destroyed by them.

*Ossification* of the glandular structure of this organ is of very infrequent occurrence. The deposit may take place in any part of the testis, but is most common towards its centre, and is generally accompanied with considerable enlargement. It is often of an earthy rather than a bony nature, being nearly destitute of animal matter, and closely resembling the earthy substance found in the lungs and bronchial glands. Such a formation is exhibited in the

Fig. 511.



Calcareous matter in the testicle.

adjoining sketch (fig. 511), from a specimen in my possession. The organ, removed from a man aged thirty, was greatly atrophied, and completely deprived of its natural structure.

5. *Cystic Disease*.—The testicle is sometimes the seat of serous cysts (fig. 512), varying in size from a mustard-seed to that of a grape, a marble, or a pigeon's egg. They are

Fig. 512.



Cystic testicle.

extremely delicate, vascular, gregarious, and filled with a thin, watery fluid, analogous to the serum of the blood. Their number may not exceed six or eight, or there may be hundreds, and even thousands. In old cases, their coats are liable to become firm, opaque, and wrinkled, their contents being thick and glairy, like the white of egg, jelly, starch, or suet. The intermediate substance is dense, solid, and often intersected by fibrous bands. The disease which is thus formed, and which is usually designated by the term *cystic sarcoma*, is of very slow growth, free from pain or constitutional disturbance, and most common between the twentieth and thirty-fifth year. It always begins in the body of the testis, the structure of which, together with that of the epididymis, is ultimately entirely destroyed. The tumor may acquire the bulk of a large fist, or

even a foetal head, and is of an oval shape, opaque, heavy to the feel,



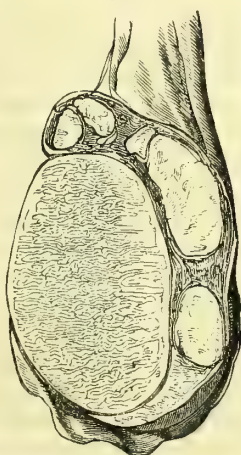
and less fluctuating than hydrocele, with which it is liable to be confounded. The epididymis retains for a long time its natural outline. The spermatic cord and the glands of the groin are never contaminated, as in encephaloid. The veins of the scrotum are usually very conspicuous. The only remedy for this affection is excision, and it is gratifying to know that the operation, when properly performed, is never followed by relapse.

6. *Tuberculosis*.—Tuberculosis of the testis is met with chiefly in young subjects of a strumous diathesis. The adventitious deposit, which is more frequent in the epididymis than in the body of the gland, exhibits the same features as in the lungs and lymphatic ganglions. It occurs in small, isolated masses, from the size of a pea to that of a bean (fig. 513), or in the form of infiltration; and, in time, often completely subverts the whole organ, transforming it into a yellowish, curdy, friable, cheese-like substance. It may be effused into the cellular tissue of the testis, but more commonly it is poured out into the seminiferous tubes. The gland is always indurated, more or less altered in shape, and somewhat enlarged. The disease commences insidiously, is unaccompanied by pain or tenderness on pressure, and often remains stationary for months, if not years. Ultimately, however, the skin becomes adherent, and of a livid hue, the tubercular matters softens, and the resulting abscess bursts, leaving an ill-looking ulcer, which remains fistulous for a long time, discharging a thin, serous pus, often intermixed with semen and particles of the morbid product.

The *treatment* of this affection is conducted on the same principles as that of tubercular disease in general. Due attention is paid to the secretions; the bowels are evacuated by mild aperients; the system is invigorated by tonics and alteratives, such as quinine, iodide of iron, Lugol's solution, or bichloride of mercury; a light, but nutritious diet is enjoined; and the patient must take regular exercise in the open air. In short, the aim of the practitioner should be to maintain the general health in as good a state as possible. If inflammation exist, it is to be combated by leeches, medicated lotions, and rest in the recumbent position. Matter is evacuated by free incision; fungous growth is subjected to the action of escharotics, or removed with the scissors; and sinuses are treated by astringent injections, or laid freely open with the knife. When the disease is indolent, the part should be pencilled every day with tincture of iodine, or rubbed with some discutient ointment. Compression by means of adhesive strips, applied in the same manner as in epididymitis, often tends to promote the absorption of the adventitious matter, and hasten the resolution of the tumor.

7. *Encephaloid*.—The most common malignant disease of the testicle is encephaloid, soft cancer, or fungus hematodes. Young persons are prin-

Fig. 513.



Tubercles of the testicle.

cipally subject to it, but adults also frequently suffer, and no period of life is exempt from it. It rarely occurs on both sides. The disease, which is always rapid in its progress, begins in the body of the testis, from which it soon spreads to the epididymis, then to the cord, and finally to the lymphatic ganglions of the groin and abdomen. The tumor is of a pyriform figure, being larger below than above, and somewhat flattened in front; knobby and irregular, pulpy and elastic, heavy, opaque, and devoid of fluctuation. It may weigh several pounds, and attain the volume of a foetal head. The disease is at first unattended with pain; but, as it progresses, the suffering often becomes very great, though it is seldom as constant and severe as in scirrhus. In the latter stages of the complaint, the countenance exhibits the greenish-yellow hue so characteristic of the carcinomatous cachexia; and the tumor, red on the surface, and traversed by large subcutaneous veins, protrudes in its well-known form of a bleeding, brain-like fungus. Under the sloughing, discharge, and pain, of which the ulcer is the seat, and the consequent hectic irritation, the patient rapidly sinks. The prognosis is unfavorable; therapeutic measures are unavailing; and ablation, however early performed, is always speedily followed by a recurrence of the disease.

8. *Scirrhus*.—Scirrhus of the testicle always occurs late in life; it begins in the body of the gland, and is, in general, very slow in its progress. The tumor, which is hard, lobulated, and misshapen, never acquires a large bulk, and is the seat of sharp, lancinating pain, accompanied by burning heat. A section of the morbid mass displays a grayish, areolar, fibrous tissue, almost destitute of vascularity, and occasionally interspersed with portions of cartilage or bone. During the progress of the disease, the spermatic cord and lymphatic ganglions of the groin become involved, the skin contracts adhesions to the subjacent parts, ulceration sets in, and the countenance assumes a characteristic sallow aspect. The complaint, which generally arises without any assignable cause, may be distinguished from other affections by its slow progress; by the small size, great firmness, and tuberculated surface of the tumor; by the peculiar nature of the pain; by the change in the complexion; by the fact that the malady always occurs in advanced life; by the want of transparency; and by the absence of varicosity of the subcutaneous veins. It is extremely infrequent, and the only remedy for it is castration, performed before there is any lymphatic or constitutional involvement.

9. *Melanosis and Colloid*.—Melanosis and colloid of the testicle are so uncommon as not to demand any special notice. The same remark is applicable to *hydatids*. A few instances have been observed, chiefly among the inhabitants of the tropics, in which this organ contained a cyst, occupied by the *filaria medinensis*, or guinea worm.

10. *Atrophy*.—Atrophy of the testicle may be induced by a great variety of causes, as excessive venery, masturbation, external violence, mechanical pressure from tumors, effused fluids, or enlarged veins, obliteration of the spermatic artery, lesion of the cerebellum, and the inordinate use of iodine, alcohol, and narcotics. Occasionally it follows neuralgia and acute orchitis. The wasting, which is usually very

gradual, is most common in young subjects, and often reduces the gland to a soft, pulpy structure, less than one-third the natural volume. The treatment is restricted, in great measure, to the removal of the exciting cause. Restoration of the normal bulk is hardly possible.

11. *Neuralgia*.—Neuralgia of the testis is chiefly observed in young subjects, of a nervous, irritable temperament, and, in general, arises without any obvious cause, though in many instances it is referred to external violence, stricture of the urethra, or disease of the prostate gland, bladder, or rectum. In most of the cases that have fallen under my notice, it was connected with dyspepsia and neuralgia of other organs. Masturbation, venereal excesses, and varicocele occasionally induce the disease. In some cases it is of a distinctly malarious origin. It is characterized by constant uneasiness, excessive morbid sensibility, and violent darting pain, which is frequently paroxysmal; it is aggravated by the slightest motion and pressure, and always extends to the neighboring parts, particularly the spermatic cord, back, and groin. Occasionally the pain is of a dull, heavy, aching nature, circumscribed, instead of diffused, and relieved rather than increased by exercise. During the height of the suffering the testicle is closely retracted, and intolerant of the slightest manipulation. In protracted cases, the general health is always materially impaired; the digestive organs are disordered; and the patient is a prey to despondency and unpleasant foreboding. There is no swelling of the testicle, and, in general, no perceptible alteration in its structure. Occasionally, however, it is very much wasted, if not entirely absorbed. The cord is usually sound.

The *treatment* is similar to that of neuralgia in other parts of the body. After a preliminary course of moderate purgation, which should never be neglected, much may be expected from a combination of quinine, aconite, strychnine, and arsenic, as recommended in a former chapter. Low diet, mercury, and blood-letting generally aggravate the complaint. Stramonium is sometimes efficacious. The best local remedies are the belladonna and veratria ointment rubbed on the scrotum and groin twice in the twenty-four hours. Temporary relief often follows the application of warm water. In some instances I have derived signal benefit from the application of a small blister to the groin, succeeded by the endermic use of sulphate of morphia. In all cases the organ must be properly suspended, and carefully protected from pressure. Castration can never be justifiable, not even when there is hopeless atrophy, inasmuch as the neuralgia would be certain to locate itself upon some other structure.

12. *Castration*.—Removal of the testicle, rendered necessary on account of different diseases, is generally a very simple operation. If the integuments are not involved, a single incision will suffice, extending from the upper to the lower part of the tumor, along its anterior surface; otherwise it must be of an elliptical form. Great care, however, must be taken not to remove too much substance, as we shall be likely to do, if we do not make proper allowance for shrinkage. The tumor during this stage of the operation is supported with the left hand, applied to its posterior surface. The next step consists in detaching



the spermatic cord from the surrounding parts, and cutting it off just above the tumor; but before this is done it is seized with a double hook, and drawn down, until its vessels are secured. A long, stout ligature being now passed through its connective tissue, but not tied, so that, in the event of secondary hemorrhage, the cord may at any moment be pulled out, the instrument is removed, and the organ rapidly detached from above downwards. In doing this, care must be taken not to wound the sound testicle or to divide the scrotal septum. From three to six little arteries will generally require ligation, and it will be well not to slight any vessel of this kind, however insignificant, otherwise secondary hemorrhage will almost be inevitable. The edges of the wound should not be brought together until at least five or six hours after the operation, its surface being in the meantime kept constantly covered with cloths wet with ice-water.

#### SECT. II.—AFFECTIONS OF THE VAGINAL TUNIC AND SPERMATIC CORD.

##### HYDROCELE.

Hydrocele is an accumulation of water in the vaginal tunic of the testicle, or in a serous cyst of the spermatic cord, between this gland and the abdominal ring. A similar affection occasionally exists in a hernial sac. It is most common in middle aged subjects, but may occur at any period of life; usually arises without any obvious cause; and presents itself in several varieties of form, as the simple, encysted, and congenital.

Hydrocele of the *vaginal tunic* may affect one side only, or it may occur on both, though this is infrequent. The fluid, varying in quantity from ten to twenty ounces, is generally thin and limpid, but in old cases, or when there is disease of the testicle, epididymis, or serous membrane, it is liable to be thick and of a yellowish, amber, or citron color. Sometimes it is red, brownish, or slightly green; and it may even be purulent, fibrinous, or intermixed with particles of cholesterine. It is free from odor, saline in its taste, and coagulable by heat, alcohol, and the dilute acids; circumstances which show its affinity with the serum of the blood from which it is derived.

The *quantity* of fluid in hydrocele is subject to much diversity; in this country it rarely, on an average, exceeds sixteen or eighteen ounces. There are cases, however, in which the quantity is much greater. Thus, Dr. Jones, who was physician to Franklin and Washington, records an instance in his work on surgery, of two gallons; and Professor May, of Washington City, has communicated to me the particulars of the case of a negro, aged sixty, of seventy-two ounces, the tumor measuring nearly twelve inches in length, and twenty-three inches in circumference. Gibbon, the historian, had a hydrocele which contained a gallon and a half of fluid. In general, the largest accumulations of this kind occur in the inhabitants of hot climates, particularly in those of the East and West Indies.

The vaginal tunic in this affection is commonly unaltered; but in

old cases it is sometimes very hard, opaque, and thickened. It is occasionally intersected by fibrinous bands, or even divided into distinct compartments, forming a sort of multilocular tumor; and cases are observed in which it contains serous cysts, hydatids, or cartilaginous concretions. The albugineous coat is seldom changed. The same is generally the case with the testicle; but occasionally this organ is enlarged and preternaturally firm, and the disease is then termed *hydro-sarcocoele*. The annexed sketch (fig. 514), from a preparation in my collection, exhibits the appearances of the parts in the more common forms of that disease.

This variety of hydrocele forms as a slow, chronic swelling, with little or no pain, and no discoloration of the skin; elastic; fluctuating; smooth on the surface; movable, but unaffected by pressure and position; translucent under transmitted light; of an ovoidal or pyriform figure; gradually ascending from the lower part of the scrotum upwards; and varying in size from a small fist to that of a foetal head. The testicle lies at the posterior part of the tumor, towards its inferior third, and the spermatic cord can generally be felt in its natural situation. The swelling is sometimes contracted at the middle so as to give it an hour-glass appearance, and not unfrequently it

assumes an elongated pyramidal form, being larger above than below. In old cases, or where the accumulation is very considerable, amounting to fifteen or twenty ounces, it is very hard, tense, and devoid both of fluctuation and translucency. The testicle is occasionally situated in front, and in quite a number of instances I have met with it at the bottom of the tumor.

The *diagnosis* is determined by the history of the tumor, by its gradual increase from below upwards, by the absence of pain, by the sickening sensation experienced on making pressure in the situation of the testicle, by the want of impulse on coughing, and by the peculiar shape of the swelling. By darkening the room, and then holding a candle opposite the tumor, at the same time that one hand is placed in front and the other behind it, a certain degree of translucency is generally perceived. In hernia, with which this affection is most liable to be confounded, the swelling begins at the abdominal ring and gradually descends; the spermatic cord is situated at the back part,

Fig. 514.



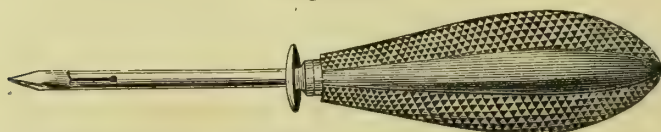
Hydrocele of the vaginal coat.

and the testicle at the bottom; there is distinct impulse on coughing; and the contents disappear on pressure, or on assuming the recumbent position. In sarcocoele and malignant disease of the testicle, the tumor feels heavier than in hydrocele, its shape is more irregular, the surface is less smooth, there is an entire absence of transparency, and the gland is deprived of its natural sensibility. In all obscure cases, an exploring needle, carefully inserted, will reveal the true nature of the affection.

*Treatment.*—Hydrocele is unattended with danger, but as it incommodates by its weight and bulk, the patient is induced in time to apply for relief. The disease occasionally disappears spontaneously during the treatment of other affections; in some instances a cure is effected by the accidental rupture of the sac by external violence; and sometimes the fluid is removed by the use of blisters, tincture of iodine, spirits of camphor, pustulation with tartrate of antimony, and lotions of hydrochlorate of ammonia. When the tumor has attained a certain bulk, nothing short of tapping is found to answer, and this operation may be performed either with a view to a palliative or a radical effect.

The *palliative* treatment is indicated chiefly when the patient is very old and feeble, or so timid as to be unwilling to submit to the radical operation; when the tumor is very large; or, lastly, when the disease is complicated with sarcocoele, enlargement of the spermatic cord, scrotal hernia, or stricture of the urethra. It consists in evacuating the fluid from time to time with a lancet, bistoury, or trocar, the patient standing up, being seated in a chair, or placed in the recumbent position. The tumor, rendered tense by grasping it behind with the left hand, is punctured at its anterior part, just below the middle by inclining the instrument obliquely upwards and backwards, in order to avoid injury to the testis. If a trocar (fig. 515) be used, the per-

Fig. 515.



forator is now withdrawn, and the canula pushed on into the sac, where it is retained until all the serum has escaped. When the operation, which is exceedingly simple and easy of execution, is over, the wound is either left uncovered, or it is closed with a piece of adhesive plaster, and the scrotum supported with a suspensory bag. Undue excitement is avoided by observing for a few days light diet and the recumbent posture. If this precaution be neglected, acute inflammation of the vaginal tunic may arise, followed by suppuration, abscess, or sloughing. The operation usually requires to be repeated in four, six, or eight months. The annexed cut (fig. 516), exhibits the manner of grasping and perforating the tumor.

The vaginal tunic may be emptied also by *acupuncture*, performed with a cataract needle, introduced at four or five different points of the



tumor. A slight oozing, or a thin, thread-like stream occasionally follows the withdrawal of the instrument; but, in general, the serum, instead of escaping externally, gradually infiltrates the cellular tissue of the scrotum, whence it is removed in two or three days by absorption. Acupuncture is applicable chiefly to recent cases of hydrocele, and is followed less quickly by re-accumulation than after the fluid has been evacuated by the trocar or knife.

For the *radical* cure of hydrocele, the principal operations are incision, excision, cauterization, the seton, and injection. Of these, the first three are nearly obsolete, and will, therefore, require but little notice. Incision, the most ancient method of all, consists in laying the sac freely open with a knife, and dressing the wound simply with lint, or some irritating substance. Acute inflammation soon succeeds, followed by suppuration, and the part finally heals by the granulating process.

Incision is objectionable in common cases, but may be advantageously resorted to when the tumor is multilocular, or when it contains cysts, hydatids, or cartilaginous concretions. Excision, which is also of considerable antiquity, was revived, in 1755, by Douglas, of England, and is performed by cutting away a portion of the serous sac with a pair of scissors, the cord and testis being left untouched. The after-treatment is the same as in incision. A modification of this operation, proposed by Mr. Kinder Wood, consists in opening the tumor with a broad-shouldered lancet, and snipping off a small piece of the vaginal tunic, previously hooked up with a tenaculum. The puncture is closed with adhesive plaster. The operation, however, rarely succeeds. The treatment by caustic was much employed during the last century, but is now entirely exploded. The caustic was applied in the same manner as for making an issue; the slough extended to the serous membrane, which, after evacuation of the fluid, gradually contracted like an ordinary abscess, and was ultimately obliterated by adhesion or granulation.

The use of the *seton* for the radical cure of hydrocele originated with the Arabians, and was much in vogue in the fourteenth century. Pott strongly recommended it, and has given a minute description of the mode of introducing it. The operation, which I prefer to every other, both on account of its simplicity, its freedom from danger, and its never-failing certainty, is performed in the same manner as in the method by injection, except that the puncture is made a little lower down. After all the water has escaped, the canula is pushed on towards

Fig. 516.



Operation of tapping hydrocele; the trocar entering.

the superior part of the scrotum, where a counter-aperture is made by the re-introduction of the perforator. The instrument being withdrawn, a piece of braid, or narrow strip of muslin, is passed through the canula by means of an eyed probe. The operation is finished by removing the canula, and tying the ends of the seton loosely in front of the scrotum. Sometimes a few threads, or a piece of thin twine, introduced with a curved needle, will answer the purpose. Whatever substance be selected, my plan is to let it remain from twenty-four to forty eight hours, or until the scrotum is quite hard, and at least one-fourth as large as before the operation. The part should, meanwhile, be properly suspended, and the patient kept on his back. For the first few days after the removal of the seton, fomentations of acetate of lead and opium are the most eligible; and these may be gradually, but cautiously, succeeded by spirituous lotions, dilute tincture of iodine, or mercurial ointment. The cure is usually completed within a fortnight. I have performed this operation many times, and have never known it to be productive of any ill effects.

The treatment by *injection* is alluded to by Celsus, but the credit of introducing it into general practice is due to Sir James Earle, who published a treatise on it in 1791. The apparatus required for the operation is a rounded trocar and canula, and a brass syringe, or gum-elastic bag, furnished with a nozzle and stopcock. Almost any kind of fluid may be used, as lime-water, milk, simple water, dilute alcohol, wine, spirits of camphor, and solutions of alum, zinc, nitre, chloride of sodium, tannin, nitrate of silver, or corrosive sublimate. Earle was in the habit of employing port wine and water, in the proportion of two-thirds of the former to one-third of the latter. At present, the favorite injection is tincture of iodine, either pure or diluted with three parts of water.

In performing the operation, the patient sits, stands, or lies, as may be most convenient, the hydrocele being punctured in the same manner as in the palliative method. After the water, however, has been evacuated, the canula is pushed in as far as possible, and the vaginal tunic carefully nipped around it with the thumb and forefinger. The tube of the syringe is then applied to the orifice of the canula, and the stimulating liquid is gradually injected, until the sac is slightly distended. It is rarely necessary to throw in more than two or three ounces, especially if the fluid be brought in contact with every part of the surface of the serous sac, as it readily may be by compressing the scrotum with the hand. In general, the injection is retained from two to five minutes, or until the patient complains of a slight sickening sensation, and of pain in the part and in the spermatic cord, when the liquid is squeezed out, and the canula withdrawn. The wound may be let alone, or be closed with a strip of adhesive plaster. When the pure tincture of iodine is used, from two to three drachms are injected, and permitted to remain permanently in the sac, from which it disappears by absorption. Usually, however, it is best to throw in several ounces of a weak solution, and to remove it as soon as it causes pain or other inconvenience. When the tumor is very large, instead of injecting it at once, it should be tapped with a trocar, and the radical treatment deferred

until the fluid has re-accumulated in smaller quantity. In case the hydrocele is double, it would be bad practice to operate upon both sides at the same time.

The treatment, after injection, is strictly antiphlogistic; the part is carefully watched, and undue action promptly met by warm saturnine fomentations, purgatives, and nauseants. If the inflammation is likely to prove insufficient, the scrotum may be kneaded with the hand, or the patient may walk about the apartment. Should the operation fail, it may be repeated as soon as there is a moderate re-accumulation of fluid. When the injection escapes into the cellular substance, the scrotum must be freely incised, and, after the fluid is pressed out, it is covered with warm fomentations.

The chief objections to this method of treatment are, first, its liability to occasional failure; secondly, the escape of the injection into the cellular tissue of the scrotum; thirdly, the difficulty of regulating the amount of inflammation; and, fourthly, the occurrence of extensive suppuration, abscess, and even sloughing. In a case which I witnessed in a young, robust mechanic, a patient of Dr. McIlwain, the injection, consisting of port wine and water, was followed by tetanus and death. The vaginal tunic was considerably thickened, and contained several ounces of sero-sanguinolent fluid, intermixed with pus and lymph; but no adhesions had taken place between the opposite sides. The patient was twenty-six years of age; and the disease made its appearance on the eighth day after the operation.

It has been proposed, within the last few years, to treat hydrocele by *electro-puncture*. The operation, which originated with Dr. Pechioli, of Italy, is performed by introducing at different points of the tumor two slender acupuncture needles, four inches in length, and connecting one to the positive and the other to the negative pole of a Daniel's constant battery. The action may be maintained from five to forty minutes. The process, which is not free from pain, is best adapted to recent cases, and is occasionally promptly followed by a cure. In general, however, it requires to be several times repeated at intervals of two or three days.

In *congenital* hydrocele, the original communication between the peritoneum and vaginal tunic continues open instead of being obliterated, as it is in the ordinary form of the complaint; and, hence, the fluid passes rapidly from one of these cavities into the other, as the bowel does in congenital hernia. The intervening canal is seldom larger than a goose-quill. The tumor, which is smooth, transparent, and fluctuating, and which usually appears soon after birth, is prolonged into the groin, and receives an impulse on coughing; it is larger in the erect than in the recumbent posture, and by gentle pressure its contents may be gradually forced into the abdomen, the testicle remaining in the scrotum. The indication is, first, to obliterate the neck of the sac, so as to cut off the communication with the peritoneal cavity; and, secondly, to encourage the removal of the fluid by absorption. This may usually be fulfilled by the constant pressure of a spring-truss, and the use of discutient lotions, iodine, or acupuncture. In adults, or in obstinate cases, the ordinary treatment may be required.



The seton and injection, before closure of the intervening canal, are liable to be followed by inflammation, which, extending to the peritoneum, might endanger life.

A hydrocele of the testis may be *encysted* (fig. 517), the water being contained in an adventitious sac, distinct from the vaginal tunic, and composed of a thin, delicate serous membrane. The tumor is small, perhaps, not larger than a common marble, tense and elastic, with little or no fluctuation and transparency, and filled with a limpid, colorless, almost uncoagulable fluid. The testicle is in front or at the side, seldom at the back, as in simple hydrocele; and the disease is commonly developed beneath the serous investment of the epididymis, though it may arise also between the vaginal and albuginous coats of the gland. When the tumor consists of two cysts, it has sometimes a lobulated appearance. The affection seldom requires interference; should it do so, it may readily be removed by a seton, consisting of a single cord of saddler's silk.

Fig. 517.



Encysted hydrocele.

Hydrocele occurs in *children*. The tumor is remarkably translucent, soft, fluctuating, and seldom larger than a hen's egg. The water often disappears spontaneously; and, when treatment is required, the means are always much milder than in hydrocele of the adult. A cure may frequently be effected in a few days by pencilling the scro-

tum with iodine, or by the use of some discutient lotion, as hydrochlorate of ammonia, alum, or acetate of lead. In two cases, I have succeeded perfectly, by letting out the water with a lancet, and then strapping the part with adhesive plaster, as in orchitis. When these means fail, acupuncture may be resorted to; or the tumor may be traversed with a delicate thread, wet with tincture of iodine, and retained from twelve to twenty-four hours; not longer, lest undue inflammation should ensue.

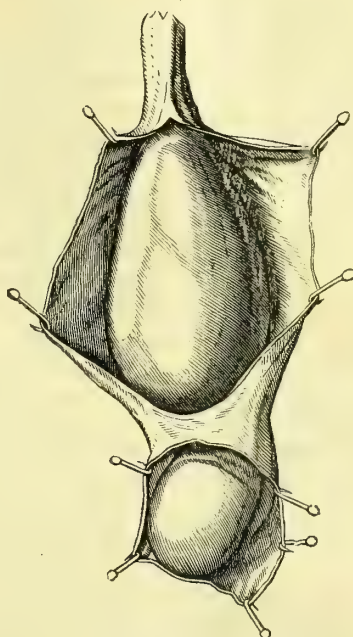
Hydrocele of the *spermatic cord* occurs under two varieties of form, the encysted and diffused. In the encysted (fig. 518), which is by far the more common, the tumor is distinctly circumscribed, of an oval figure, from the size of a small marble to that of a hen's egg, and filled with a limpid or pale straw-colored fluid. Fluctuation and translucency, never well-marked, may be entirely absent. The swelling, which is movable, free from pain, and distinct from the testicle, receives no impulse in coughing, and cannot be emptied by pressure; circumstances which clearly distinguish it from hernia and hydrocele of the vaginal tunic. It may be situated at the upper part of the scrotum, just below the external ring, or even in the inguinal canal. The cyst of which it is composed, and which is generally single, originates, either adventitiously or in an imperfect obliteration of the tubular prolongation of the peritoneum, and lies under cover of the common integuments, superficial fascia, and fibres of the cremaster muscle. The

affection, although it occurs at all periods of life, is most common in infants. It may vanish spontaneously, and should never be interfered with as long as it does not cause any serious inconvenience. In all cases demanding treatment, fair trial should be given to mild means; if these fail, and they generally do so in adults, the best remedy is the seton, introduced with a large curved needle, and retained until the part is slightly inflamed.

Fig. 518.



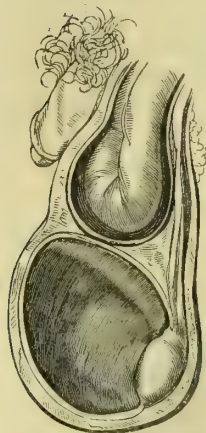
Fig. 519.



Diffused hydrocele of the cord.

In *diffused* hydrocele (fig. 519), the fluid accumulates in the cellular tissue of the cord, the meshes of which, scarcely perceptible in the natural state, are converted into cells, from the size of a pea to that of a hazelnut. Gradually some of these cells give way, from the pressure of their contents, and thus one or more large cavities are formed, which are always most distinct at the base of the swelling. The hydrocele, at its commencement, is of a cylindrical shape; but at a later period, it becomes pyramidal when the patient stands, and oblong, or nearly of equal dimensions throughout, when he is recumbent. It is inclosed in a cellular sheath, which is covered by the cremaster muscle, and extends from the testicle, which is below, to the external ring, into the inguinal canal, and occasionally even into the abdominal cavity. A tumor of this description has a uniform surface and definite shape, is slow in its formation, is not attended with any considerable pain, and is separated from the vaginal tunic by a distinct septum. It is liable to be confounded with omental hernia, but is distinguished from it by not receiving an impulse in coughing,

Fig. 520.



Hydrocele associated with hernia.

by its imperfect removal under pressure, by the fluctuation at its lower part, and by the change of figure which it undergoes in the recumbent position. Acupuncture will sometimes effect a cure, especially if aided by pressure with a compress and roller; but a small seton is a safer and surer remedy. Free incision, as practised by Pott, is not to be thought of. As long as the tumor is small, and produces no pain or inconvenience, interference is unnecessary.

*Hernial Hydrocele.*—The sac of an old scrotal hernia, after the obliteration of its neck, sometimes becomes dropsical, constituting what is termed *oscheo-hydrocele*. The tumor is of considerable bulk, pyramidal, fluctuating, translucent, and occupied by a viscid, amber-colored fluid. The diagnosis is easy, and the treatment the same as in ordinary hydrocele. Occasionally, the two diseases co-exist, as is shown in the adjoining sketch (fig. 520), where

the sac of an inguinal hernia is situated immediately above a small hydrocele of the vaginal tunic.

#### HEMATOCELE.

By hematocele (fig. 521) is understood a collection of blood in the vaginal tunic of the testicle, or in a cyst of the spermatic cord. In the

Fig. 521.



Hematocele of the scrotum.

former case, which is by far the more common of the two, the swelling is either globular or pyramidal, being larger below than above, opaque, tense, heavy, and nearly free from fluctuation. The blood, varying in quantity from a few ounces to half a gallon, is of a dark brown color; or, if some time has elapsed, of the color of coffee-grounds, partly fluid, and partly coagulated. In old cases, it is occasionally lamelliform and organized, as in an aneurismal sac. The vaginal tunic may be natural, opaque and wrinkled, thickened and indurated, or soft and pulpy. The testis is generally sound. The hemorrhage may be caused by the spontaneous rupture of a vessel; but usually it is referable to a wound, bruise, or blow. The disease may occur alone, or in union with

hydrocele, when it is commonly produced by tapping.

Hematocele is distinguished from other affections by its sudden development, its solid feel, the absence of translucency, its dark color, its obscure fluctuation, and the fact that it is almost always occasioned by external injury.

The indication is to prevent inflammation, and to encourage the removal of the effused blood by sorbefacients. If these means fail, and

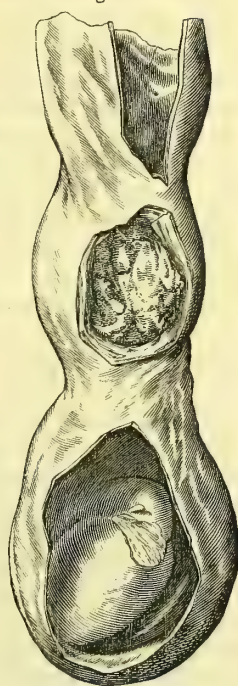


the blood acts as a foreign substance, causing pain, swelling, and suppuration, a free incision is made along the centre of the tumor, and the wound healed by the granulating process. When there is much thickening of the vaginal tunic, it may be necessary to cut away a portion of the diseased membrane. If the extravasation coexists with hydrocele, the tumor is evacuated with a lancet, and immediately after traversed with a seton.

Hematocele of the spermatic cord is uncommon, and is nearly always associated with, or consequent upon, encysted hydrocele. The tumor is hard, small, and filled with grumous blood, or bloody serum, which gives it a dark color. The history of the case, and the introduction of an exploring needle will render the diagnosis sufficiently easy. The treatment is the same as for hematocele of the vaginal tunic of the testis.

Blood is sometimes infiltrated into the cellular tissue of the scrotum and spermatic cord, from a strain, bruise, blow, or kick; the part is of a dark livid color, and suddenly increases to three or four times the natural bulk. It is analogous to extravasation in other regions, and requires the same mode of treatment.

Fig. 522.

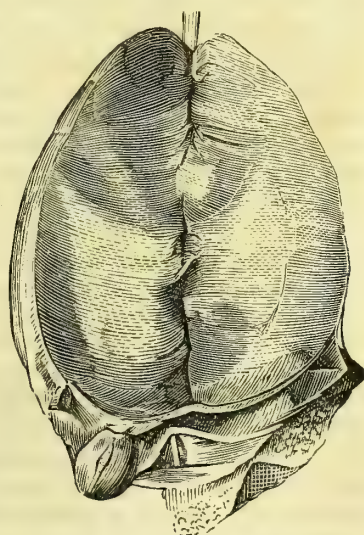


Encysted hematocele of the cord.

#### FIBROUS TUMORS.

Fibrous tumors occasionally grow within the vaginal tunic, the testis retaining its integrity. Some years ago I operated upon a colored man, aged twenty-five, removing from the left side a fibrous mass weighing nearly five pounds. It was of an ovoidal form, larger below than above, and was eight inches and a quarter in length by thirteen in circumference at its widest part. Its surface was perfectly smooth, and adherent, in the greater portion of its extent, to the vaginal tunic, by loose cellular substance. The testicle was situated at the lower extremity of the tumor, and, with the exception of being slightly flattened, had undergone no appreciable alteration. The deferent duct, also perfectly sound, ran along the posterior surface of the tumor.

Fig. 523.



Fibrous tumor of the vaginal tunic.

A section of the mass exhibited a smooth, uniform surface, of a pale, grayish color. It was slightly elastic, almost incompressible, and remarkably solid, offering great resistance to the knife. A thin slice of it was opaque, and nearly as tough as sole-leather. No free cellular tissue could be detected. The tumor had been growing for upwards of five years—during the last eighteen months very rapidly—but caused no other inconvenience than what resulted from its weight and bulk. The spermatic cord, the skin of the scrotum, and the ganglions of the groin were perfectly healthy. The patient recovered from the operation, but died some months afterwards of pulmonary phthisis. Fig. 523 exhibits the form and structure of the tumor; the testicle is seen at the base, to the left of the median line.

#### VARICOCELE.

By varicocele is understood a dilated and tortuous state of the veins of the spermatic cord. It generally arises soon after puberty, but occasionally it occurs later, and now and then I have met with it as early as the eleventh year. It is almost exclusively confined to the left side, for the reason, as Dr. Brinton, of this city, has demonstrated, that the left spermatic vein at its entrance into the emulgent is unprovided with a valve, whereas such an arrangement exists distinctly on the right side, where the vein embogues into the vena cava. Besides, the left vein is naturally considerably longer than the right, and its direction also is more at a right angle with the current of the blood.

The affection may be induced by whatever has a tendency to facilitate an afflux of blood to the genital organs, or to serve as a habitual barrier to its return to the heart. Hence the most common causes are, venereal excesses, masturbation, chronic disease of the scrotum and testicle, riding on horseback, bodily fatigue, and pressure on the spermatic vessels from distention of the iliac portion of the colon, the presence of tumors in the groin or pelvis, and the wearing of ill-constructed trusses. Constant relaxation of the scrotum, however induced, powerfully predisposes to the formation of the disease. It is very probable that there exists in many cases, if not in most, a natural tendency to this enlargement. What corroborates this idea is that it often begins very early in life, before the causes here referred to can exert any injurious influence, and the fact that it occasionally occurs in several members of the same family.

Varicocele is usually slow in its progress, and is attended with a dull, heavy, aching pain, which often extends up the cord to the groin, and even to the back. In some cases the pain is of a neuralgic nature. A sense of weight is commonly experienced in the testicle, which, in time, is liable to become soft and shrunken, from the pressure of the enlarged and distended veins. The scrotum of the affected side is very prone to perspiration, and is often remarkably flabby, elongated, and pendulous, especially after exercise. The general health rarely suffers; but in many cases there is a gloomy and melancholy state

of the mind, almost bordering upon alienation, and unfitting the patient for active exertion.

When the disease is fully developed, the veins are convoluted, knotty, elongated, harder in some places than in others, and irregularly dilated, some of them being more than six times the ordinary volume (fig. 524). Their parietes are very thick, dense, and rigid at some points, and very brittle and attenuated at others. In cases of long standing, some of the vessels are completely obliterated by adhesive inflammation, or by the formation of fibrinous concretions in their interior. Phlebolites are also occasionally found in them. The connecting cellular tissue does not experience any particular alteration, but the veins of the testicle itself are often considerably enlarged, as are also those which ramify between the vaginal and albugineous coats.

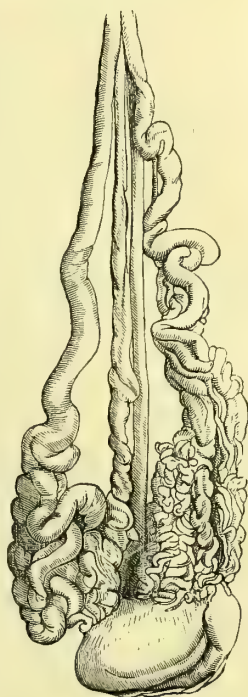
The tumor resulting from the enlarged and dilated veins is of an elongated, conical shape, irregular and compressible, feeling very much like a bundle of cords, a cluster of earthworms, or a mass of the intestines of a rat. It has neither the regular outline and elastic feel of hydrocele, the firmness and globular character of sarcocele, nor the doughy consistence of scrotal hernia. The distended vessels are frequently distinctly visible through the skin.

When the tumor is very voluminous, it may extend from the lower margin of the testis to the external ring; and in this case there is always considerable enlargement of the subcutaneous veins of the scrotum.

Although the symptoms of this affection are usually well marked, yet it is liable to be *confounded* with other lesions. The one for which it is most apt to be mistaken is scrotal hernia, especially that variety in which the omentum is concerned. In order to distinguish between the two diseases, the patient is placed on his back, and the scrotum held up until it is entirely empty; the finger is then applied to the external ring, and the patient requested to rise, when, if the case is varicocele, the tumor will immediately reappear, whereas, if it be hernia, the bowel will be unable to descend. A more certain mode of determining the diagnosis is to compress the neck of the swelling, in the erect position, when, if composed of intestine, it will remain stationary, but will become more tense if it consist of dilated veins.

The *treatment* of varicocele is palliative and radical. The former, which, in ordinary cases, is alone resorted to, consists in wearing a gum-elastic bag, in washing the parts frequently with cold water, or some astringent lotion, and in carefully avoiding everything calculated to favor a determination of blood to the spermatic vessels. To obtain full advantage from these measures, the patient must pay strict atten-

Fig. 524.



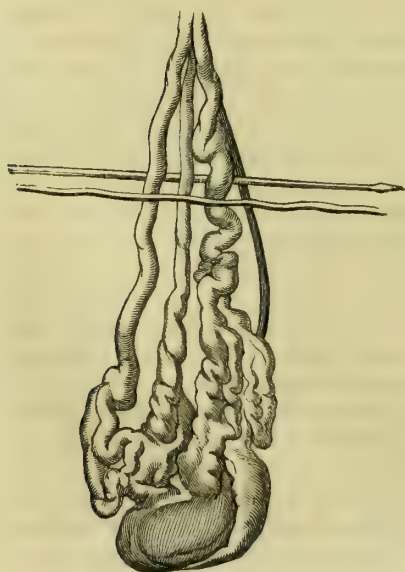


tion to his bowels, and refrain from horseback exercise, fatiguing walks, protracted standing, dancing, warm bathing, and venereal excesses.

For the *radical* treatment, which may become necessary when there is much local suffering, with danger of atrophy of the testicle, or when the patient's mind is so much affected as to render him unfit for active exertion, various operations have been proposed. With some of the ancients the actual cautery was a favorite remedy; Gooch and other surgeons have reported cases cured by castration; some prefer ligation, others excision of the affected veins; occasionally the spermatic artery has been tied; in the hands of Breschet compression with a pair of flattened screw-forceps is said to have frequently succeeded; Sir Astley Cooper has recommended excision of a portion of the scrotum; and Velpeau, Davat, Frické, Grossheim, Reynaud, and Vidal, have each devised and practised ingenious subcutaneous operations for its relief. The method which I formerly employed consisted in exposing the enlarged veins, and strangulating them with the twisted suture. The scrotum having been rendered tense by grasping it behind with the left hand, a vertical incision, about an inch in length, was made over the anterior part of the swelling, down to the vessels, which were then carefully isolated from the accompanying duct, artery, and nerves, by a few touches of the point of the scalpel. A slender darning-needle was next passed underneath the enlarged trunks, and secured by passing around them a stout thread, in the form of the figure 8. The operation was finished by closing the wound with one or two twisted sutures. In twenty-four hours the large needle was removed, and the strangulated mass divided with a narrow bistoury.

I had performed this operation with the most gratifying results in

Fig. 525.



fifteen cases, when one of my patients unexpectedly perished of phlebitis; a circumstance which led me to abandon it. Of late years, I have limited myself altogether to subcutaneous ligation, which I believe to be perfectly safe under all circumstances, as well as permanently successful. The operation consists in ligating (fig. 525) the enlarged veins, previously isolated from the deferent tube, with a stout cord, well waxed, and passed with a long, spear-shaped needle, from before backwards, by making only two punctures, one in front and the other behind, as is easily done, simply by compelling the instrument to retrace its steps. The ends of the ligature are then firmly tied over a perforated button, or, what answers

quite as well, a piece of cork. If necessary, it may occasionally be tightened. At the expiration of a week, it may usually be withdrawn, the veins being sufficiently divided and occluded to prevent a return of the circulation. The patient is kept in bed upon light diet, with the scrotum well suspended, and constantly wet with cold water, a grain of morphia being administered immediately after the operation, which is always performed with the aid of chloroform. The hardness and swelling, consequent upon the ligation of the veins, gradually disappear spontaneously, or under the influence of sorbefacient applications.

When the scrotum is very flabby and pendulous, the superfluous portion should be retrenched with the knife; care being taken to tie up every bleeding vessel, and to approximate the edges of the wound with the continued suture, which answers much better here than the interrupted. I have performed this operation several times with very excellent results.

### SECT. III.—AFFECTIONS OF THE SCROTUM.

The scrotum is liable to inflammation and its consequences, different kinds of eruptions, hypertrophy, tumors, varix, and carcinoma.

1. *Inflammation* of the scrotum may present itself in various forms, as the simple, traumatic, and erysipelatous, of which the latter is the only one requiring even a passing notice. It may exist by itself, or in union with the same disease in other parts of the body, and requires particular attention on account of its liability to terminate in sloughing. Elderly persons, of dilapidated constitution and intemperate habits, are its most frequent subjects. The disease is characterized by extensive swelling, from the infiltration of sero-plastic matter; the parts feel doughy and inelastic, readily pitting on pressure; the pain is of a smarting, burning nature; and the surface is of a pale-reddish, glossy appearance. More or less constitutional disturbance is present, the symptoms not unfrequently assuming a typhoid type. Extensive sloughing may occur, exposing the testes merely suspended by their cords.

The proper *treatment* consists in attention to the general health by means of tonics, stimulants, and alterants, and in the application of tincture of iodine, with saturnine and anodyne fomentations, the parts being suspended in the usual manner. Tension is relieved, and matter evacuated, by suitable incisions.

2. A peculiar *sloughing* disease occasionally occurs in the scrotum of young children. In a case which I saw many years ago in an infant two weeks old, an eschar, about an inch in diameter, suddenly formed over the right testicle, leaving the vaginal tunic perfectly denuded, and producing an angry-looking sore, with hard, glossy edges, reposing upon black-colored cellular tissue. The spermatic cord was indurated, tumid, and remarkably tender on pressure. The constitution did not seem to suffer much. In the course of twenty-four hours after these symptoms were discovered, the vaginal sac

became distended; and, on puncturing it, a considerable quantity of sero-purulent fluid, of a yellowish color, followed the lancet. A small portion of the membrane now sloughed, leaving the gland quite bare. By touching the part with lunar caustic, and applying a yeast poultice, granulations gradually sprouted up, and the infant got well.

3. *Psoriasis* sometimes forms on the scrotum, the skin of which becomes cracked, or fissured, red, inflamed, thickened, and affected with the most intolerable itching. The disease, which is often associated with psoriasis of the perineum, anus, groin, and inside of the thighs, is produced by various causes, both local and constitutional, and is mostly met with in middle-aged and elderly subjects, of a delicate skin, and light complexion. It is frequently very intractable, and then always constitutes a source of excessive suffering.

In the *treatment* of this affection, diligent search must be made for the exciting cause, the removal of which alone often promptly arrests the morbid action. In general, it will be found to be intimately connected with disorder of the constitution, or derangement of the digestive organs, thus pointing to the necessity of a properly regulated diet, the employment of purgatives, and the exhibition of alterants, as blue mass and ipecacuanha, along with the antimonial and saline mixture. Iodide of potassium and sarsaparilla are of no use. The best local remedies are weak solutions of iodine, acetate of lead, and bichloride of mercury. In my own practice, however, I have found no application so soothing and effectual as the dilute ointment of the nitrate of mercury, in the proportion of ten grains to the drachm of simple cerate.

4. *Hypertrophy* of the scrotum, sometimes existing as a congenital defect, is usually the result of long-continued distention and pressure consequent upon hernia, hydrocele, varicocele, and other tumors. It presents itself in varying degrees, from slight increase of the parts to the development of a tumor of large bulk and firm consistence. The treatment is palliative and radical; the former consisting in steady, systematic suspension, the latter, in careful retrenchment.

5. The *sebaceous* tumor is occasionally met with in the scrotum, existing just beneath the skin, which is generally so thin and transparent as to allow the contents of the growth to be distinctly visible. It sometimes occurs in considerable numbers. Interference is unnecessary, unless the tumors are so large as to incommode by their bulk and weight, which, however, is seldom the case.

6. *Earthy concretions*, from the volume of a pea to that of an almond, now and then form in the scrotum, their number being sometimes quite considerable. Of a dull whitish, or grayish color, they are of a cretaceous consistence, and are composed mainly of carbonate and phosphate of lime, cemented together by a small quantity of animal matter. They are of tardy formation, and are found exclusively in middle-aged and elderly subjects, in connection with hypertrophy of the scrotum. The proper remedy is excision.

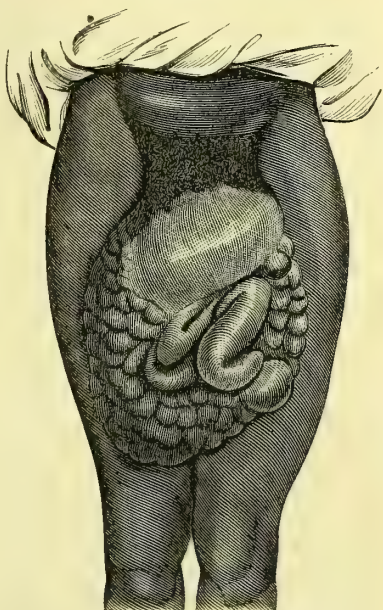
7. The scrotum sometimes contains *cysts* communicating with the urethra, and filled with *calculi*. The composition of the latter is



variable, but, in general, they consist of uric acid; they are usually quite smooth, ovoidal or spherical in their shape, and from the size of a millet-seed up to that of a Lima bean. Their number is sometimes remarkable, nearly as many as one hundred having been found in a single cyst. The cyst itself is commonly very thick, dense, and rough, especially in old cases. The only available treatment is excision.

8. The scrotum is liable to be transformed into a hard, fleshy mass, constituting what is termed *elephantiasis* or *sarcomatous* enlargement. The enormous magnitude which this disease may attain is almost incredible. A surgeon of the West Indies removed a tumor of this kind from the scrotum of a negro, which weighed seventy pounds; and Baron Larrey has detailed the particulars of another, which was supposed to weigh one hundred and twenty pounds. In the medical museum at Montpellier is a diseased mass of this character, which was preserved by Delpech, the weight of which is one hundred and sixty pounds. In my private collection is a specimen of elephantiasis, presented to me by Dr. Bozeman, of Alabama, which weighs forty pounds. The mass began early in life, and grew until the patient, a colored man, was twenty years old, when it was excised by that distinguished young surgeon. The adjoining cut (fig. 526), exhibits an excellent view of this tumor.

Fig. 526.



Hypertrophy, or elephantiasis of the scrotum.

The disease is seldom observed in this country or in Europe; but in some parts of Asia, Africa, South America, and the West Indies, its occurrence is not infrequent. Externally, the morbid growth is rough and fissured, and its surface, particularly in old cases, is covered with yellowish, scaly crusts, the detachment of which leaves so many small, herpetic sores, emitting a thin, ichorous discharge. The skin is very thick and indurated; the cellular tissue is firm and scirrhus, from the distention of its cavities with semi-concrete, albuminous matter; the bloodvessels of the part are remarkably large and varicose; and the swelling is indolent, incommoding rather by its weight and bulk than by its pain. In its shape it is mostly pyriform, but sometimes ovoidal, or globular. The testicle is not necessarily implicated in this disease, nor is the spermatic cord so much indurated and enlarged as in some of the other disorders of the genital apparatus. The morbid mass occasionally ulcerates; and a case has been related by Hendy in

which it was invaded by mortification, causing the death of the patient. The disease is often complicated with hydrocele, and occasionally with scrotal hernia.

In the early stage of this disease relief may be attempted, though even then with hardly any prospect of success, by means of sorbefacients and systematic compression, steadily pursued for many months together. When the growth has acquired a large bulk the only remedy is excision, performed with special reference to the avoidance of hemorrhage and shock, which have nearly always proved fatal, when the tumor has been of extraordinary size. If I had to deal with such a case, I should be tempted to cut away the mass piecemeal at several sittings, tying the vessels as they are divided, and using the actual cautery to sear, if necessary, the raw surface. Or, instead of this, removal might be affected partly by the knife, and partly by the *écraseur*. Liston and Key, in a case of this kind, lost each his patient upon the table; Dr. Bozeman's died nearly a fortnight after the operation, from the effects of peritonitis caused by an extension of the inflammation along the spermatic cord. Both testes were included in the excision, and the man lost only twenty ounces of blood. One of the most successful operations of this kind, upon record, was performed in 1837, by Dr. Picton, of New Orleans. The disease had existed for ten years, and the tumor weighed fifty-three pounds. Liston extirpated one that weighed forty-four pounds, his patient also making an excellent recovery.

9. The scrotum has been known to contain cysts filled with various kinds of *fœtal remains*, as pieces of bone, teeth, hair, and soft matter. Remarkable cases of this description, all examples of monstrosity by inclusion, have been reported, among others, by Dietrich, Eke, André, Velpeau, and Verneuil. The tumor varies in size from that of an egg to that of the fist, and is always easily recognized by its history, its stationary, or nearly stationary, character, and the irregularity of its consistence, some parts being hard, and others comparatively soft.

Fig. 527.



Generally, the surgeon has no difficulty in tracing the outlines of some of the bones. Excision constitutes the proper treatment. The testicle may sometimes be saved, but in most cases it is so intimately involved in the tumor as to require to be sacrificed.

10. *Varix* of the scrotum is uncommon, and is observed chiefly in old bulky hydroceles and ruptures. In the case from which the annexed drawing (fig. 527) was taken, the affection was conjoined with varix of the legs, abdomen, and penis. The enlargement, although enormous, created no particular inconvenience. The patient was a common laborer, aged fifty, otherwise in good health. Should the disease become

a source of suffering, relief should be sought in suspension and astringent lotions; or, if need be, in subcutaneous ligation.

11. *Carcinoma* of the scrotum is generally of the epithelial kind, and seldom occurs before puberty, its favorite period of attack being from the thirtieth to the fortieth year. It is most common in chimney-sweepers; and hence it has by some been named the chimney-sweeper's cancer (fig. 528). The affection generally begins at the base of the scrotum, in the form of a small, wart-like excrescence, covered by a thin, scaly crust. After this has continued for a time, the hardened cuticle sloughs off, leaving a superficial, painful, ill-looking ulcer, with indurated and everted edges. The surface of the sore has a red, excoriated aspect, and discharges a thin, sanguinolent fluid, often highly irritating and offensive. In this way the ulcerative process gradually extends, until at length a large surface of the scrotum, together with the vaginal tunic and the exterior of the testicle, is involved in the disease. In this advanced stage, the cellular tissue around the sore is generally white and scirrhus; and the inguinal ganglions on one or both sides are enlarged, injected, and, in some instances, filled with cancerous matter.

The progress of carcinoma of the scrotum is generally comparatively slow; there is less local and constitutional suffering than in cancer of other parts of the body, and death seldom occurs under four or five years. A case has been reported of a chimney sweep who lived upwards of forty years with a disease of this kind. The diagnosis of carcinoma of the scrotum is sufficiently easy, the peculiar appearance, situation, and feel of the tumor, and the history of the case, always serving to distinguish it from other affections. The only remedy is early and free excision, before there is any lymphatic involvement.

Fig. 528.



An aggravated example of chimney-sweeper's cancer; with much destruction of the superficial texture.

#### SECT. IV.—AFFECTIONS OF THE PENIS.

This organ is liable to wounds, morbid erections, ulcers, degeneration of its sheath and septum, carcinoma, and a peculiar incurvation usually associated with abnormal shortening.

1. *Wounds* of the penis may be accidental, or self-inflicted, and may exhibit themselves in various forms and degrees. The treatment must be regulated by the same rules as that of similar injuries in other parts of the body. When the organ is partially separated by a clean cut, stitches should be freely used, along with strips of collodion, care being taken afterwards to prevent displacement by guarding against the occurrence of erections. In the event of complete severance, re-union may reasonably be expected to ensue, provided the parts are promptly and effectually restored to their natural position over a catheter. Cold water-dressing constitutes the best application.



*Laceration* of the fibrous sheath of the cavernous body of the penis is occasionally met with; generally as a consequence of a blow while the organ is in a state of inordinate erection, during sexual intercourse, or in act of onanism. The occurrence of the accident is generally denoted by a feeling as if something had suddenly given way, instantly followed by collapse, and by a copious extravasation of blood, distending the organ in every direction, and rapidly diffusing itself over the neighboring parts, as the scrotum, perineum, and even the pubes. Sometimes a distinct noise is heard, at the moment of the rupture, not unlike the crack of a whip. The penis is commonly inclined a little towards the sound side, and the site of the injury is readily distinguished by the finger.

The proper treatment of this affection is rest of the penis in an elevated position, with discutient applications, as saturnine and spirituous lotions, followed by dilute tincture of iodine, soap liniment, and tincture of arnica and camphor. If blood is extensively effused into the cavernous structure of the penis, a free incision should be made, to squeeze out the clots, otherwise they may become intermixed with lymph, and thus undergo partial organization, much to the detriment of the functions of the organ.

2. *Phlebitis* of the penis is uncommon. I have, however, observed several well-marked cases of it, occurring in the dorsal veins, in consequence, apparently, of irritation produced in sexual intercourse. The disease, which is sometimes associated with angeioleucitis, is characterized by a phlogosed, turgescient appearance of the organ, and by a tender, corded, and enlarged state of the dorsal veins, extending as far back as the root of the penis. Rest and elevation of the organ, the application of saturnine and anodyne lotions, light diet, and a brisk purgative, constitute the proper treatment.

3. *Morbid erections* of the penis may be produced by inflammation, followed by an effusion of lymph into the cells of the cavernous bodies. I have never inspected a case of this kind after death, but observed one several years ago in a young mechanic, which lasted for nearly four weeks, in spite of the most rigid antiphlogistic measures. It came on soon after intercourse, and was attended with excessive pain, together with much constitutional disturbance. For several months after the violence of the disease had abated, the organ remained small, flaccid, and incapable of complete erection. Sometimes the priapism is caused by an effusion of pure blood, in which case, if the fluid is not removed, the individual becomes permanently impotent. Priapism of a severe character sometimes supervenes upon injury of the spine and cerebellum. It may also be caused by the inordinate use of cantharides.

Ordinary cases of priapism are treated with cold applications, and with the liberal use of anodynes, exhibited either by the mouth or by the rectum. In the more severe forms, bleeding at the arm and by leeches, active purgatives, antimonials, and even slight pyalism may be necessary. If retention of urine takes place, relief must be afforded with the catheter. When the morbid erections depend upon

an effusion of blood, free incisions should be made to turn out the clots; if not all, as many as possible.

4. *Ulcers* of the penis, specific and non-specific, will be found described in the chapter on syphilis, and need not, therefore, detain us here, beyond the statement that the subject is one of great practical importance, both as it respects the peace of mind and the physical welfare of the patient. I am satisfied, from much observation, that the most simple ulcers of the penis are frequently mistaken by practitioners for syphilitic, and that, in consequence of these errors of diagnosis, persons are constantly subjected to severe courses of mercury that would get well in a few days under the most simple treatment. I have seen many a constitution permanently ruined in this way.

5. The pectiniform septum of the penis is liable to the *fibrous* transformation. I recollect a curious instance of this kind in a patient of Dr. George McClellan, for whose relief that gentleman was obliged to perform an operation. The man was between fifty and sixty years of age; the disease had been coming on gradually; and the organ was curved towards the perineum to such a degree as to interfere materially with copulation. The operation, which consisted in the excision of the offending substance, was entirely successful. Such a lesion, as may readily be conceived, might become a cause of impotence.

The fibrous sheath of the cavernous body is sometimes affected in a similar manner as the pectiniform septum. The transformation, according to my observation, is most common in persons from thirty to forty years of age, and usually occurs in small patches, from the size of a three-cent piece to that of a dime. Persons who indulge much in sexual intercourse are, I believe, most liable to it. When several such spots exist, they may interfere materially with the erection of the penis, and thus become a source of great mental annoyance to the individual, seriously compromising his happiness, as I have seen in several instances.

The *treatment* of these affections is not very satisfactory. In their earlier stages, benefit may accrue from the application of sorbefacients, and subcutaneous scarification; but when the deposit is old, firm, and thoroughly organized, nothing short of excision will answer. The operation is sufficiently easy, and is not attended with any serious hemorrhage.

6. The penis is liable to *carcinoma*, chiefly of the epithelial form. The disease usually begins as a little wart, tubercle, or fissure, on the head of the penis, or the foreskin, from which it gradually spreads to the other structures, until the greater portion is destroyed. The resulting ulcer is at first quite small and superficial; by and by, however, it becomes broader and broader, and, at last, throws out a cauliflower-like fungus. There is now a profuse discharge of thin, sanious, and offensive matter, the inguinal glands rapidly enlarge, and the patient is harassed with severe, lancinating pains, darting up towards the abdomen, his constitution being at the same time completely undermined by the local disease. Cancer of the penis is most common in old men, and its occurrence is generally supposed to be favored by the existence

of a long and tight prepuce. Of the truth of this opinion, however, my own experience has not furnished me with any examples.

Cancer of this organ pursues a comparatively tardy course, and does not relapse so soon after removal as cancer in other parts of the body. In one of my cases, that of a medical gentleman, upwards of fifty, five years have elapsed since the operation, and still there is no sign of a return of the malady. Sooner or later, however, the disease breaks out again, despite of all that can be done to prevent it. When amputation is performed, the knife should always be carried through the sound tissues. No operation is, of course, proper when there is lymphatic involvement.

7. *Incurvation* of the penis is a congenital affection, complicated with abnormal brevity and hypospadias, or malformation of the urethra, which is either deficient, or opens some distance behind its usual situation. The consequence is that the organ is bent very considerably backwards towards the scrotum, exhibiting thus not only an unseemly appearance, but interfering materially with copulation.

To remedy this defect, an ingenious operation has been devised by Professor Pancoast, consisting in the excision of a V-shaped portion of the cavernous bodies, the first incision being made immediately behind the head of the penis. The portion excised should just be large enough to relieve the deformity, and no more. No skin is removed, and care is taken not to interfere with the urethra. The arteries, generally three or four in number, being secured, the edges of the wound are carefully approximated by the interrupted suture, carried through the fibrous sheath of the cavernous bodies, the edges of the integuments being tacked together separately. The organ is then placed in an elevated position upon a gutta-percha or leather splint, and kept constantly wet with cold water. Erections are controlled by the usual means. The stitches are removed in from five to eight days. No untoward symptoms follow the operation, and the result is most gratifying. The whole procedure, it will be perceived, is similar to that involved in Barton's operation for the cure of anchylosis.

8. *Amputation* of the penis, rendered necessary on account of cancerous disease, is one of the easiest operations in surgery. The integument being slightly retracted by an assistant, the surgeon embraces the penis, behind the seat of the disease, with a pair of slender polypus-forceps, inclining a little obliquely from behind forwards, and then, with one sweep of a small catlin, or large bistoury, severs it from above downwards. The arteries being drawn out and tied, the mucous membrane of the urethra is tacked at four different points of its extent to the edges of the cutaneous portion of the wound, the object of the procedure being the prevention of contraction of the canal, which is so liable to follow the ordinary operation. No catheter need be inserted during the cure.



## SECT. V.—AFFECTIONS OF THE PREPUCE.

The prepuce is liable to various kinds of ulcers, warty excrescences, phymosis, paraphymosis, and the formation of calculous concretions.

1. The *herpetic ulcer* is observed chiefly in young adults, on the inner surface of the prepuce, or at the junction of the skin and mucous membrane. They manifest themselves by inflamed spots, of a bright red color, varying in size from that of a millet-seed to that of a split pea. Small vesicles soon succeed, of a globular shape, remarkably transparent, agglomerated, and containing at first a serous, and subsequently a puriform fluid. On the internal surface, these vesicles lead to the development of thin, flat scales which fall off about the fifth day, leaving a corresponding number of round, yellowish excoriations; on the external surface, rough, irregular scabs form. By running together, these ulcers occasionally form one unbroken sore, occupying nearly the whole of the prepuce. This disease is very apt to recur, and is usually attended with some itching, but rarely with pain. The exciting causes are friction, want of cleanliness, and disorder of the digestive organs. Persons of a delicate skin, and of a red complexion, are most prone to its attacks. The diagnosis between herpes and chancre is described in the chapter on syphilis.

The *treatment* consists in the use of a brisk purgative, and light, cooling diet, with frequent ablutions of the affected surface, and the steady applications of lint saturated with weak solutions of tannin, zinc, or lead, or with very weak yellow wash, as one-fourth of a grain to the ounce of lime-water. The dilute ointment of the nitrate of mercury is also an excellent remedy. Mercury should never be used.

2. The *psoriatic ulcer* is most frequently met with in persons who have the foreskin unnaturally long, moist, and tender. It is an obstinate and painful disease, characterized by deep cracks, or fissures, on the edges of the prepuce, which becomes gradually thickened, hardened, and so corrugated as to occasion phymosis. The number of ulcers is sometimes quite considerable; they are very tender and unseemly; apt to bleed when injured; extremely difficult to heal; and, if large, attended with a copious, puriform discharge. Small, brownish-looking scales occasionally form on these sores.

The causes and treatment of psoriasis of the prepuce are similar to those of herpes. When the disease is unusually obstinate, slight pyalism, maintained for several weeks, is sometimes necessary.

3. The penis is liable to the development of *warty excrescences* (fig. 529), as a consequence chiefly of gonorrhœa, or of impure connection with females laboring under leucorrhœa and other discharges. Although they may occupy any portion of the organ, they are most common around the neck and at the side of the

Fig. 529.



Warts on the penis.

frenum, where they often occur in immense numbers, from the size of a pin-head up to that of a pea; they are usually of a conical shape, with a rather small pedicle, rough, fissured, or tuberculated, of a firm consistence, of a bright florid color, and of a fibrous structure. When these vegetations are very numerous they form a large tumor beneath the prepuce, discharging an abundance of horribly fetid pus. They frequently bleed on the slightest touch, and are always extremely prone to recur after extirpation.

The most effectual remedy for these warty excrescences, in their earlier stages, is chromic acid, applied with a piece of soft wood, their surface having previously been divested of moisture. Repetition is effected every third or fourth day, the parts being in the meantime frequently washed, and kept asunder by the interposition of dry lint, which is also one of the best means for preventing relapse. When the excrescences are very large and old, hardly anything short of excision will be likely to do any good. The operation is easily performed with the scissors, but is always very painful, and occasionally quite bloody. Dry lint is applied after the bleeding has ceased, and the next day the surface is gently touched with chromic acid. When the repullulating disposition is very strong, the patient should be subjected to the use of iodide of potassium, with minute doses of bichloride of mercury.

4. *Phymosis* (fig. 530) consists in a contracted and elongated condition of the prepuce, attended with an inability to uncover the head of

Fig. 530.



Phymosis.

the penis. It presents itself in two varieties of form, the congenital and the acquired. In the first, the narrowing of the prepuce depends chiefly, if not exclusively, upon the tightness of the mucous membrane, the other component parts retaining their natural character; in the other all the structures are condensed by inflammatory deposits, the result usually of gonorrhœa and chancre. However induced, the affection requires proper attention, as it always interferes with cleanliness and comfort, if not also with copulation. It has been supposed that, by retaining the irritating secretions of the sebaceous follicles, it might become an

exciting cause of cancer of the penis and prepuce, but the opinion does not seem to be well founded.

When the tightness exists with unusual elongation of the prepuce, the proper procedure is circumcision. With this view the redundant parts, steadied with a pair of slender forceps, applied just in front of the head of the penis, are cut off with one sweep of a long bistoury from above downwards and from behind forwards. The contracted and tightened membrane is then, if necessary, divided with the scissors. Any little arteries that may bleed are secured with fine ligatures, when the muco-cutaneous edges of the wound are approximated with four sutures, placed at equidistant intervals. Elevation of the penis with

cold water-dressing, recumbency, light diet, and a purgative the morning after the operation, constitutes the after-treatment. The sutures are removed at the end of the third day.

When phymosis is unattended by elongation, relief may be afforded by slitting up the prepuce in front, along the middle line, over a grooved director, as far back as the posterior extremity of the glans, the edges of the wound being afterwards tacked together by several points of the interrupted suture (fig. 531). The angles of the flaps are gradually rounded off, assuming, ultimately, a very seemly appearance. Or, instead of this, we may adopt the method of Cullerier, of dividing the tightened mucous membrane, at three or four points, with a delicate pair of scissors, the sharp blade of which is thrust into the connecting cellular substance, and carried as high up as the origin of the prepuce, while the blunt-pointed one glides harmlessly over the head of the penis.

Fig. 531.



The acquired form of phymosis often disappears of its own accord, or under the influence of sorbefacient applications, as mercurial ointment, or dilute tincture of iodine, and frequently-repeated pressure with the thumb and finger. When intractable, it must be treated upon the same principles as congenital phymosis; that is, by excision, or excision and incision.

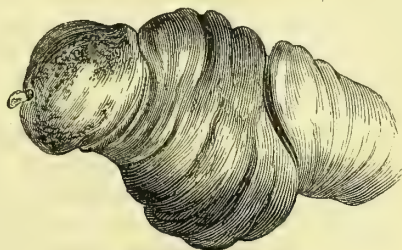
5. *Paraphymosis* (fig. 532) is the reverse of phymosis, and is always an accidental occurrence, causing a stricture just behind the head of the penis, which, in severe and neglected cases, may not only produce

Fig. 532.



Paraphymosis.

Fig. 533.



great suffering, but mortification of the strangulated tissues; or, at all events, great swelling, pain, and tenderness, from inflammatory deposits, especially serous, as seen in the adjoining cut (fig. 533). The accident is usually caused by retracting the prepuce with a view of uncovering the head of the penis, the person being afterwards unable to restore it to its proper position. Inflammation soon arises, followed by the symptoms just described.

The proper *treatment* in paraphymosis is to restore the parts as



promptly as possible to their natural relations, which may always be done without difficulty soon after the accident, but often not without great trouble when severe inflammation and swelling exist.

Fig. 534.



The proper procedure, in ordinary cases, consists in applying pressure to the head of the penis and the dislocated prepuce in opposite directions, by means of the thumbs and fingers, arranged in the manner exhibited in the annexed cut (fig. 534). The best plan usually is to squeeze out the blood as much as possible from the turgid glans, before we attempt to push the prepuce forwards. Sometimes this object may be greatly facilitated, especially in recent cases, by

pouring upon the part, from a considerable height, a steady stream of cold water. When the prepuce is hard and oedematous, the serum should be well drained off by numerous small punctures before any attempt is made at reduction. When restoration is impracticable by the means now described, recourse must be had to the division of the stricture, which is a very simple affair, all that is necessary being a small incision through the constricted skin, just behind the crown of the penis. Cold water-dressing for the first few days, and afterwards sorbefacient applications, will be necessary to place the parts in their proper condition.

6. When the prepuce is very long and narrow, it may become a receptacle for *calculous concretions*, of which some very curious examples are upon record. They are usually composed of uric acid, and vary in size from that of a mustard-seed to that of an almond. Their shape is spherical, or ovoidal, their surface rough or smooth, their color grayish or pale ash. They are formed directly from the urine, which, in consequence of the difficulty of its escape through the narrow orifice of the prepuce, deposits its salts in the abnormal pouch, which is always more or less hypertrophied.

These concretions sometimes exist in extraordinary numbers. Thus, in a specimen in my possession, kindly presented to me by Dr. John G. Kerr, of Canton, China, there are not less than one hundred and three, varying from the volume of a pin's head to that of a pea, their aggregate weight being two drachms. In another specimen, removed by the same gentleman from a man forty-five years old, there is a solitary calculus, closely resembling, in size and shape, the head of the penis. The affection seems to be common at Canton, as Dr. Kerr met with six cases of it in one year.

Dislodgment of these bodies is always readily accomplished by incision of the prepuce. If the parts be greatly hypertrophied, the necessary retrenchment is effected immediately after the extraction.

## SECT. VI.—GONORRHŒA.

Gonorrhœa is an inflammation of the mucous membrane of the urethra, produced by the contact of a specific virus. This virus, as has been established by numerous experiments, conducted in the most careful and unexceptionable manner, has no properties whatever in common with that of syphilis, notwithstanding it was at one time supposed that they were identical, or, if not absolutely identical, at all events, under certain circumstances, convertible, as respects their effects. The test of inoculation, however, has thoroughly dispelled this delusion, which could only have had its origin in the fact of the occasional co-existence of gonorrhœa and chancre.

Of the essential nature of the *virus* of gonorrhœa nothing is known; all that has been ascertained respecting it is that it resides in the purulent matter which its presence excites during the existence of the specific inflammation, and that it requires a mucous surface for the development and display of its peculiar action. Placed in contact with the cutaneous tissue, or, with any other tissue than the mucous, it is incapable of producing any other effect than ordinary pus; the part, it is true, may slightly inflame, and even suppurate, but the fluid thus derived possesses none of the properties of gonorrhœal matter, and is therefore wholly innocuous. The disease to which it gives rise is strictly of a local nature, being exclusively limited in its action to the mucous membranes, especially those of the genito-urinary organs, and has the faculty of gradually wearing itself out, or of disappearing spontaneously. In all these respects, as well as others that will hereafter be mentioned, it differs essentially and characteristically from the poison of syphilis, which is capable, not only of producing a severe local disease, but also of contaminating the whole system, the blood as well as the solids, and of thus engendering a diathesis which is transmissible from the parent to the offspring. How long the virus of gonorrhœa retains its infectious properties, after it has awakened the specific inflammation, is a question which has not been satisfactorily settled; much will, doubtless, depend upon circumstances, the period being comparatively short in some cases, and the reverse in others.

The term gonorrhœa, by which this affection is usually designated by English writers, is not happily chosen, as it originally signified a discharge of spermatic fluid, the older practitioners having erroneously supposed that the flow which accompanies the inflammation was merely an increase of the natural secretion. The word *blennorrhagia*, employed by modern French authors, is equally objectionable, since it simply implies a flow of mucus, whereas, in true gonorrhœa, the discharge is purulent, or composed of a mixture of pus and mucus. The word *clap* is a vulgar expression, denotive of the filthy condition of the parts. Capuron has proposed the appellation of *venereal catarrh*, while another syphilographer has given it the name of *puorrhœa*, in allusion to the fact, just mentioned, that the inflammation is characterized by a discharge of pus. Although the term gonorrhœa is objectionable in a scientific point of view, yet as its import is well understood

by the profession, and, moreover, as it has been sanctioned by long usage, it should not be discarded.

The poison of gonorrhœa, as already stated, is capable of producing its specific effect only upon the mucous tissues, and its predilection for the genito-urinary mucous surfaces is well known. In the male, the parts usually affected are the urethra, the head of the penis, and the inner surface of the prepuce; in the female, the lining membrane of the vulva, vagina, and uterus, is most liable to suffer, the urethra often escaping entirely, even when the attack is of more than ordinary severity. In both sexes, the disease, in consequence of direct inoculation, occasionally attacks the anus, the nose, and the conjunctiva of the eye, frequently destroying sight in less than twenty-four hours after the commencement of the morbid action.

The period of *latency* of the gonorrhœal poison, or the interval which intervenes between the impure connection and the development of the disease, probably not exceeds a few hours, although from three to five days usually elapse before it exhibits any well-marked symptoms. Occasionally, however, the peculiar discharge shows itself as early as six, twelve, or fifteen hours, and, on the other hand, cases are seen where it does not appear before the expiration of a week or more. There is a great difference, in this respect, in different individuals, some being extremely susceptible to the impression of the virus, while others are almost proof against its attacks in any event. Young men with a large orifice of the urethra, and a tender, delicate skin, with a predisposition to herpetic affections of the cutaneous and mucous tissues, are particularly liable to suffer. A long and narrow prepuce, entangling and retaining the virus, is another circumstance favoring the development of the disease. One attack of gonorrhœa is no protection against another. We occasionally meet with men who are literally habitually laboring under the disease; no matter what precaution they may employ, they can never have intercourse without becoming inoculated. They contract the affection as easily as tinder catches fire. The smallest spark of virus is sufficient to kindle the disease.

*Symptoms.*—Gonorrhœa may, practically considered, be regarded as consisting of three stages, each of them marked by a certain train of phenomena, giving them a sufficiently distinctive character. The first may be called the formative stage, the second the stage of maturity, or full development, and the third the stage of decline.

The first stage, comprising the initiatory steps of the disease, is announced, as its very first symptom, by a sense of titillation along the course of the urethra, especially at its anterior extremity, and by a feeling of turgescence and weight in the penis. Shortly after this, the orifice of the tube is observed to be red and pouting, and glued up with a thin, whitish secretion; the head of the penis has a swollen and phlogosed appearance; some degree of scalding is experienced in voiding urine; and, upon pressing the urethra, a small quantity of watery mucus can be squeezed out. The fluid is merely an increase of the natural secretion of the part; it is somewhat viscid, though hardly as much so as in health, and if any of it fall upon the patient's



linen, it is very apt to leave a little darkish stain, the spot feeling slightly stiff.

The first stage seldom lasts beyond a day or two, and occasionally, indeed, not more than a few hours, when it is succeeded by the second. The fire, previously kindled, now bursts forth in a full flame, and the disease soon reaches its acme. Every symptom is declarative of inflammatory action. The discharge is now quite abundant, often amounting to several drachms in the twenty-four hours; of a thick, ropy, cream-like consistence, and of a light-yellowish color, generally bordering upon greenish. In case the morbid action runs very high, it is not uncommon for the pus to contain more or less lymph, thereby augmenting its consistence, and also pure blood, the result, probably, of a rupture of some of the minute vessels of the mucous membrane. The whole penis is now very much swollen, tender, and painful, its head being extremely red and congested, and the prepuce enlarged and œdematous; the scalding in voiding urine is violent, and the stream is often much diminished in size; there is a frequent disposition to erections; and the system, sympathizing with the local disorder, is feverish and uncomfortable. When the inflammation is of extraordinary severity, there is apt to be serious involvement of the neighboring parts, along with soreness of the testicles, groins, and perineum, and tumefaction of the veins and lymphatics of the dorsum of the penis.

These symptoms may last for several weeks, and they will be very apt to do so unless combated by appropriate means. Sometimes they subside under very simple treatment; at other times, and more generally, active measures are required for their subjugation. As the inflammation subsides, the discharge diminishes in quantity, and changes in quality, becoming small, thin, and pale, resembling weak whey, or a thin mixture of mucus, or mucus and pus, in water. Occasionally it is of a thin, turbid nature, or slightly sanguinolent, leaving a characteristic stain upon the patient's linen. There is now comparatively little scalding in micturition; the stream of urine is also more bold; and there is less tendency to morbid erections. The disease, in fact, is in a subacute state; it has lost its severity, and is manifestly on the decline, subject, however, upon the slightest exposure, or from the most trifling irregularity, to a resumption of all its former intensity. In this way it may flow and ebb, now advancing and now receding, for weeks and even months, without any apparent indication as to a final cure. Having reached this point, the term *chronic* is applied to it, or, as expressive of the nature of the discharge, the word *gleet*, the fluid being of a thin, whitish character, small in quantity, and but little different from the natural secretion, unless it be temporarily changed by a re-accession of inflammation. It is generally somewhat viscid, and hence it is apt to glue together the edges of the orifice of the urethra, particularly in the morning, and after exercise. The quantity of fluid sometimes does not exceed a few drops in the twenty-four hours; at other times, it is more considerable, and then leaves, perhaps, several distinct marks upon the patient's linen. Occasionally almost the only discharge is a whitish, flaky substance, looking very

much like little fragments of soft-boiled rice, and sure to cause the patient a great deal of anxiety, and the surgeon no little annoyance.

There is a form of gonorrhœa, in both sexes, in which, instead of the usual discharge, the parts are remarkably free from moisture, constituting what the older writers were in the habit of calling a *gonorrhœa sicca*, or dry clap. It is characterized by a high degree of scalding in micturition, excessive soreness and tenderness in the penis and circumjacent parts, and by a great tendency to morbid erections, the inflamed surface being uncommonly red and congested. The dryness rarely continues beyond a day or two, when it is generally succeeded by an abundant, greenish, muco-purulent discharge, not unfrequently intermixed with pure blood, indicative of the intensity of the morbid action.

*Pathology.*—The pathology of gonorrhœa is now well understood. It is essentially, from first to last, an inflammation of the mucous tissue of the urethra, the intensity of its action varying in the several stages into which the disease is usually divided. The primary impression is generally made upon the anterior portion of the canal, not occupying, perhaps, more than a few lines of its surface, but as it advances it gradually, and sometimes rapidly, extends over the greater part of the lining membrane, reaching as far back as the neck of the bladder, and forwards to the head of the penis, and even to the prepuce. But few opportunities have been afforded of inspecting, after death, the urethra of persons affected with acute gonorrhœa, but enough has been learned to show that, when in this condition, its mucous membrane is of a red, florid complexion, from the injection of its capillary vessels, and that there is marked enlargement of its follicles, especially of the lacunæ of Morgagni, which, from their great size in the natural state, would often seem to be obliged to bear the chief burden of the disease, the morbid action frequently lingering here long after it has ceased in the other structures. A knowledge of this fact is of no inconsiderable practical importance, as it serves to explain the astonishing obstinacy which, in many cases, characterizes gonorrhœa, depending apparently upon the difficulty of medicating the interior of these follicles, owing to their depth and peculiar position rendering it difficult to force injecting matter into them. The free surface of the canal is occasionally, perhaps, indeed, not unfrequently, incrustated with little patches of lymph, but this is rather a matter of inference than of actual observation; it is, however, a reasonable inference, deriving confirmation, first, from analogy, or from what occurs in inflammation in other mucous tissues, and, secondly, from the fact that the purulent discharge, when at its height, often contains flakes of plastic substance.

In addition to the above appearances, it is usual to find considerable thickening of the mucous membrane, thus accounting for the diminished size of the stream of urine; and, in the more violent forms of the disease, there is always an effusion of plastic matter into the cells of the spongy substance of the urethra, causing that peculiar incurvation of the penis which attends its morbid erections. When the gonorrhœa extends far back, the glands of Cowper are liable to become involved, and it is well known that the prostate gland, the neck of the

bladder, and, in fact, the whole seminal apparatus, not unfrequently suffer, especially when the disease continues uncommonly long in a very active condition. It was formerly supposed that such an amount of discharge as generally attends specific inflammation of the urethra was closely connected with an ulcerated condition of its mucous membrane; but dissection has proved that this is not the case; it is only when gonorrhœa is associated with chancre of this canal, a very rare event, however, that such an occurrence is at all likely to happen.

*Complications.*—Gonorrhœa may exist in a very simple form, passing through its different stages without infringing in the least upon the rights of any tissues save those primarily and necessarily implicated. In general, however, it encroaches more or less upon the surrounding structures, thus producing those more severe and distressing symptoms which so often characterize the lesion. These secondary affections, or complications, as they may be termed, coming on at a variable period during the progress of the inflammation, are chordee, cystitis, epididymitis, bubo, retention of urine, hemorrhage, chancre, and abscess of the urethra, perineum, and prostate gland.

*Chordee* is the technical name for the morbid erections which attend gonorrhœa; the occurrence is extremely common, and is generally a source of great distress; it is never absent during the height of the inflammation, and is always most severe at night, when the patient becomes warm in bed, or the mind is engaged upon a lascivious dream, an unchaste image, or an impure thought. Its attacks are variable; it often comes and goes several times during the night, and, not unfrequently, it lasts for hours together, causing sleeplessness and excessive pain, the more so because it is entirely involuntary, the organ refusing to be controlled by any effort of the will. In the more violent forms of the disease, it is attended with a remarkable incurvation of the penis, the organ being bent backwards towards the perineum, in consequence of the distention of the cells of the erectile structure of the urethra by lymph, thus preventing the influx of blood necessary to the erection of the affected tissue. When the distention is unequal, the penis is sometimes drawn to one side. Occasionally the cavernous bodies suffer in a similar manner, though in a less degree.

*Cystitis*, as a complication of gonorrhœa, is caused by an extension of the inflammation from the urethra to the bladder, along the mucous membrane, affording, thus, an example of the propagation of disease by continuity of structure. It often supervenes at an early stage of the morbid action, and forms an exceedingly disagreeable concomitant, being characterized by an almost constant desire to urinate, heat and pain deep down in the pelvis, and a sense of burning or scalding in micturition, especially at the close of the operation. The inflammation is confined, in great measure, to the neck of the bladder. When very severe, it may be accompanied by a discharge of puriform matter, or even pure blood, although such an occurrence is very unusual.

The immediate cause of *epididymitis* is, generally, a repulsion of the gonorrhœal inflammation, in consequence of exposure to cold, or the use of irritating injections. It rarely sets in before the end of the second week or the beginning of the third; and, although it commonly



begins in the epididymis, it rapidly extends to the testicle, so that the two may be said to be implicated nearly in an equal degree. The swelling and other symptoms are well marked, and the suffering is often intense, the system frequently deeply sympathizing with the local disorder. The original seat of the inflammation is the mucous lining of the seminal passages, but it almost invariably affects only one testicle. During the height of the disease, and sometimes even at an early period, there is almost always a suppression of the gonorrhœal discharge.

*Bubo* is an occasional sequence of gonorrhœa; it is most liable to form in young subjects, after exposure to cold, or severe fatigue, and is usually confined to one groin, the lymphatic ganglions of which become enlarged, tender, and painful, though they rarely suppurate. The swelling may be seated above Poupart's ligament, but, in a majority of instances, it will be found below, the number of ganglions concerned varying from one to three or four.

In consequence of the inflammatory irritation of the urethra and neck of the bladder, such an amount of spasm may be produced in the latter organ as to give rise to *retention of urine*. The affection is characterized, in addition to the symptoms ordinarily present under such circumstances, by excessive burning and smarting along the course of the urinary passages, and by a great deal of soreness and tenderness in the perineum and anus.

*Hemorrhage* of the urethra, as attendant upon gonorrhœa, is an uncommon occurrence; it generally takes place during a violent erection, in consequence of a rupture of some of the vessels of the mucous membrane, and may be so considerable as to require active measures for its suppression. There is nothing definite as to its seat, though, in general, it will be found to be located in front of the pubic portion of the canal.

The co-existence of gonorrhœa and *chancre* of the urethra is probably more common than is generally imagined, and it was this circumstance, no doubt, which led to the notion, at one time so common among surgeons, of the identity of the two diseases. As this subject, however, has received due attention in the chapter on syphilis, all that is here necessary is to state that the chancre is usually situated in the anterior extremity of the canal, just within, or a little beyond, the meatus, where its presence is always indicated by a circumscribed hardness, and, not unfrequently, also, by all the visible signs of an ulcer.

Finally, gonorrhœa is occasionally productive of *abscesses* in the submucous or subcutaneous cellular tissue of the urethra, preceded by the ordinary phenomena of inflammation, and pointing in various situations, sometimes along the spongy portion of the tube, sometimes in the perineum, and sometimes, again, in the region of the prostate gland. Such an occurrence, which, happily, is uncommon, is most liable to happen in persons in whom the specific disease is coincident with stricture of the urethra, leading to great difficulty in micturition.

Such is a brief account of the more common and more immediate consequences of gonorrhœa; to complete the history of this part of

the inquiry, it is necessary to add that the disease often leads to stricture of the urethra, owing to the protracted inflammatory action of the mucous membrane, and the inevitable effusion of plastic matter into its substance. There is reason to believe, as has been stated elsewhere, that this lesion is more frequently produced by gonorrhœa than by all other causes whatsoever.

Besides the local effects of gonorrhœa now considered, there are others which are of a general character, and which may, therefore, be said to be *constitutional*. The affections which are usually described as belonging to this category, are gonorrhœal rheumatism, ophthalmia, and cutaneous eruptions, more especially some of the scaly forms. These affections are, it would seem, remarkably common in London, in consequence, as is supposed, of the damp, cold, and variable state of the atmosphere so prevalent in the British metropolis. In this country their occurrence is extremely infrequent, and from never having witnessed any instances of them in my own practice, or in that of my friends, either hospital or private, I am strongly inclined to the opinion that their existence is entirely imaginary. I have certainly seen enough cases of gonorrhœa to justify me in believing that, if these secondary affections were of such frequent occurrence as they are represented to be, instances would occasionally have fallen under my observation, and thus afforded me an opportunity of studying their history. But no such opportunity has occurred, and I am, therefore, inclined to regard the supervention of these so-called secondary affections, not as a result of the direct action of the gonorrhœal poison upon the system, but as a mere coincidence, taking its place in a constitution strongly predisposed, by hereditary influence, atmospheric vicissitudes, and the debility occasioned by the treatment of the original disease, to the development of rheumatism in various parts of the body, particularly the joints, muscles, and sclerotic coat of the eye. I cannot, indeed, conceive how the subject can be viewed in any other light. All pathologists are agreed that gonorrhœa is strictly a local malady, and that the poison produced by it, although it may be absorbed into the system, is incapable of contaminating the solids and fluids, in the sense in which this question is regarded when the poison of chancre has been conveyed into the body. If gonorrhœa is a constitutional disease in one case, it ought to be so, as a general rule, in all, the same law holding good here as in syphilis, and yet every one knows that this is not true. In warm climates nothing is ever heard of gonorrhœal rheumatism, whereas syphilis, in its secondary and tertiary forms, is unusually rife in all southern and inter-tropical regions. Mr. Acton, who is a firm believer in this doctrine, became its advocate only after his settlement in London, having, in the first edition of his *Treatise on the Diseases of the Urinary and Generative Organs*, composed chiefly at Paris, expressed a doubt in respect to the possibility of all such occurrences. In the British metropolis, meeting with a different class of patients, persons who are proverbially prone to rheumatism and gout, he has had occasion to notice the coincidence so frequently that he is now inclined to look upon these affections in the light of cause and effect, forgetting that these very

persons might contract rheumatism and gout just as readily from any other cause, serving to debilitate the system and to impair the digestive apparatus. He expressly declares that gonorrhœal rheumatism, in whatever form it may appear, is generally only witnessed in young, delicate individuals, laboring under a hereditary predisposition to the disease, and that the secondary affection always, under such circumstances, displays its worst character. I deny, then, unequivocally, the existence of rheumatism as a consequence of the absorption of the gonorrhœal poison, or as an effect of metastasis, sympathy, or revulsion. I am willing, however, to admit that a person who is naturally, or from disease, predisposed to rheumatism, will, especially if badly treated, or exposed to cold and other depressing influences during the progress of the urethral lesion, be more likely to contract the constitutional disorder than he otherwise would be. To go beyond this is, I imagine, not warranted, either by the history of these affections, or by our knowledge of the nature and habits of the gonorrhœal virus.

The scaly eruptions of the skin, and the soreness of the throat, affections particularly adverted to by some recent authorities, probably depend upon the absorption of chancrous matter, and not upon any malign agency exerted by the poison of gonorrhœa. This view of the subject will appear the more plausible, when it is remembered that these consecutive affections of the cutaneous and mucous tissues are well-known results of syphilis, especially of its milder forms. It is only necessary to suppose, what, indeed, so often happens in venereal diseases, that the patient is simultaneously affected with gonorrhœa and chancre, or that the latter malady has somewhat preceded the former, and all the difficulty with which the subject is invested will at once vanish.

Gonorrhœa of the urethra occasionally co-exists with gonorrhœa of the head of the penis and prepuce, known under the name of *balanitis*, from a Greek word signifying gland. The two affections may arise simultaneously, or one may take precedence of the other, and they may go on together for an indefinite period, though, in general, the latter disappears long before the former, being much more amenable to medication than the disease of the urethra. The reason why the gland does not always participate in the inflammation of the canal is simply because, from its constant exposure and consequent hardness, it loses, in great measure, its susceptibility to morbid impressions. What corroborates this statement is that balanitis, spurious, or preputial gonorrhœa, as it is variously termed, is almost exclusively confined to young subjects with a long, narrow, and very sensitive foreskin. An infection of such a nature is almost unknown in the Israelite, who, in obedience to the requirements of the rites of his church, is compelled to part with this cutaneous appendage at the end of the first week of his life.

The disease is usually well marked from its commencement, the prominent symptoms consisting of more or less pain and itching, along with a discolored and abraded appearance of the inflamed surface, marked tumefaction of the prepuce, which is often quite œdematous, and an abundant puriform discharge, of a peculiarly fetid and irritat-



ing character, apparently from the admixture of sebaceous matter, which is always so copiously secreted in this disease. The morbid action is especially severe along the gutter behind the crown of the penis, at the point of reflection of the prepuce, depending upon the remarkably delicate, vascular, and glandular structure there.

The diagnosis is always very easy when we are able to retract the foreskin, but when this covering is unusually narrow it is often very difficult, if not impossible, to determine the precise source of the discharge, as it may, under such circumstances, proceed entirely from the urethra, or partly from the urethra and partly from the head of the penis. The principal signs of distinction are, the smaller amount of pain and scalding in micturition in balanitis than in urethral gonorrhœa, the more profuse discharge, the more severe swelling, the slighter tendency to chordee, and the more tractable character of the malady. The discharge may proceed from a concealed chancre, but in this case it will not only be profuse, but very abundant, and there will, besides, be a circumscribed hardness, easily distinguishable by the touch.

*Treatment.*—In the treatment of gonorrhœa it is important not to lose sight of the several stages of which we have considered it as consisting, since they must necessarily exert a modifying influence upon the employment of our therapeutic measures.

It has been a general belief among the profession, which has been gradually gaining ground for several years past, that an incipient gonorrhœa might, if properly managed, be cut short, or be made to abort. A course of treatment, consisting principally of injections, aided by repose and light diet, and bearing the imposing name of *ectrotic*, has, accordingly, been devised by a French syphilographer, and much insisted upon both by himself and his disciples as almost, if not completely, infallible. The article, serving as the basis of this medication, is nitrate of silver, in the proportion of a quarter of a grain to the ounce of water, and injected every four hours for two successive days, unless it be found, in the meantime, that the discharge assumes a thin, sero-sanguinolent character, the natural effect of the remedy, when it is to be discontinued sooner. The intention of this treatment, which, we are told, should be conjoined with perfect rest, abstinence from animal food, and the use of diluent drinks, is to subvert the specific inflammation, before it is fully developed, by the substitution of one of an entirely simple character.

Another plan, the very opposite of the above, as far as the local measure is concerned, and of English origin, proposes to attain the same end by the use of a strong solution of nitrate of silver, containing at least ten grains of the salt to the ounce of water, and introduced once a day, until there is unequivocal evidence of a complete change in the nature of the morbid action. The credit of devising this mode of treatment is, I believe, usually ascribed to the late Dr. Wallace, of Dublin.

I allude to these two modes of practice merely for the purpose of condemning them, being satisfied, from ample experience, that, although they may sometimes succeed in arresting the disease in its incipency, yet, in general, they either completely fail, or, what is worse, only

aggravate the existing trouble, increasing the discharge, pain, and scalding of the urethra, protracting the attack, and endangering the safety of the epididymis and testicle. A much more rational plan, because a much safer one, is to treat the disease, in this stage, with the mildest possible injections, consisting of a very weak solution of acetate of zinc or lead, in water, the quantity of the salt not exceeding the fourth or third of a grain to the ounce. This may be thrown up three times in the day, and often exercises a wonderfully controlling influence over the disease. Or, instead of this, an injection of two grains of tannin to the ounce of water may be employed several times in the twenty-four hours. Finally, I frequently use, with the happiest effect, as an injection, in this stage of the disorder, simple tepid water, green table tea, or some mucilaginous fluid, with which a few drops of laudanum have been mixed. I have myself always found that the more mild and soothing the treatment is during the incubative period the more likely it will be to prove beneficial in arresting the disease, and this is a point upon which it is impossible to insist too strongly with the young and inexperienced practitioner, who is too apt to commit the very serious mistake of employing harsh remedies where those of an opposite kind alone are admissible. Along with these means it is important that the patient should be kept perfectly quiet, abstaining from meat, condiments, and stimulating drink; that free use should be made of demulcent fluids; and that the parts should be well fomented with cloths wrung out of warm water. If these means do not produce speedy delitescence, I do not know anything that will.

In the second stage, when the disease has become fully established, as denoted by the excessive discharge, the pain and scalding in passing water, and the phlogosed condition of the penis, the treatment must be essentially antiphlogistic, precisely as in ordinary inflammation of a severe character. The practitioner must lose sight entirely of the specificalness of the disease, and look upon it in the light solely of a common affection. If the patient is young and plethoric, he should be bled freely at the arm, and immediately after take a brisk purgative; he should then be subjected to the exhibition of the antimonial and saline mixture, repeated at such intervals and in such doses as will maintain slight nausea and a gentle action on the bowels; perfect repose of mind and body is enjoined, the diet must be very mild and restricted, and the urine should be rendered as bland as possible by the use of demulcent drinks, as gum water, or linseed tea. If chordee prove troublesome, a full anodyne is given in the evening.

The local treatment is of the most gentle kind. The complaining organ is placed in an easy, elevated position, and frequently immersed, for half an hour at a time, in a tincupful of tepid water, containing a small teaspoonful of common salt, the object being not only to soothe and relax the parts, but to promote cleanliness. If the pain and swelling be considerable, the whole genitals, together with the hypogastrium and perineum, are kept constantly wet with cloths wrung out of hot water, either simple, or medicated with laudanum or hops, and covered with oiled silk. Under similar circumstances, leeches are sometimes service-

able, from fifteen to twenty being applied to the groin, pubes, and perineum, the flow of blood being afterwards promoted by the ordinary means. The only direct medication during this period, is an injection of tepid water, repeated from six to ten times in the twenty-four hours. The diet must, of course, be of a character to correspond with the other measures.

This treatment need seldom be continued longer than three or four days, even in the most severe forms of the disease; at the end of this time the inflammation is generally sufficiently subdued to justify the employment of what are usually considered, and not without reason, as the specific remedies for this disorder. These are the *copaiba* and *cubebs*, whose efficacy in relieving gonorrhœa has long been thoroughly established, so much so that they are used by every one in every case of the disease. By many, indeed, they are habitually employed without any preparation whatever either of the part or system, in all stages of the affection, from its first inception to its final termination as a gleet. In the early part of my professional life, governed by the influences around me, I pursued this practice in consonance with the rest of my brethren, but I soon learned its injurious effects, and, therefore, abandoned it. Its occasional success is indisputable, but more frequently, by far, it allows the disease to go on unrestrained, and the consequence is that, in many cases, it is indefinitely protracted. Hence, I am satisfied that it is always best to precede the exhibition of these and other kindred articles by antiphlogistic measures. The inflammation being subdued in this way, the beneficial effects of *copaiba* and *cubebs*, especially of the former, are often most rapid and striking.

The dose and mode of administration of the balsam of *copaiba* deserve consideration. Many persons will readily bear a drachm, three times a day, but a smaller quantity than this will generally make nearly as strong an impression upon the disease, while it is much less liable to disturb the stomach and bowels, and cause eruptions of the skin. Indeed, I have often found that a third or fourth of a drachm will answer every purpose for which the article can be given. The most eligible form of exhibition is that of emulsion, prepared by rubbing the balsam up in gum Arabic and loaf sugar, to which are afterwards added camphor water and spirit of nitric ether, with a little tincture of opium. The camphor water is a valuable ingredient on account of its soothing effects upon the genito-urinary apparatus, and may be administered three times daily, in doses varying from two to four drachms. The dose of nitric ether should not exceed ten or twelve drops, as only the slightest possible impression upon the renal secretion is aimed at. When the *copaiba* causes acid eructations, nausea, griping, or diarrhœa, a minute portion of morphia, or a few drops of acetated tincture of opium, may advantageously be combined with it. As camphor water is not always agreeable, a good substitute may generally be found in cinnamon, mint, or ginger water. When there is much scalding in voiding urine, or an unpleasant eruption of the skin, I generally add to each dose of the mixture a few grains of bicarbonate of soda, or, what is preferable, enjoin the free use of alkaline and demulcent drinks.

When the *copaiba* emulsion disagrees with the digestive organs, it



has been proposed to administer it by the rectum, as an injection, but such a mode of medication is not only very inefficient, but extremely disgusting, and has, therefore, found little favor with practitioners. Under similar circumstances, the copaiba capsule is often used, the balsam being thus conveyed, without coming in contact with the gustatory nerves, into the stomach, where, its envelop being dissolved by the gastric juice, it soon enters the circulation, producing an effect like that which results from the use of the emulsion, although less rapid, and, on the whole, also less beneficial. It is for this reason, therefore, that the fluid preparation deserves a decided preference. The number of capsules to be taken in the twenty-four hours varies from three to six, sometimes one, and at other times two being employed at a dose. There is a preparation of copaiba, formerly much in vogue, but now very justly discarded, on account of its inertness, consisting of a combination of this article with carbonate of magnesia, administered in pill form.

The effects of copaiba may be so distressing as to render it absolutely necessary to abandon its use altogether. In this case it may be advantageously replaced by *cubebs*, or trial may be made of the two articles in combination, experience having shown that the modifying influence thus produced occasionally enhances their beneficial effects, at the same time that it renders the stomach more tolerant of their presence. The usual dose of powdered cubebs, the only form in which it is administered in gonorrhœa, is one drachm, three times daily, in a little milk, but twice, and even thrice this quantity may be given without detriment. In fact, it generally requires rather a large dose to produce any marked effect at all.

Of the two articles here mentioned as the great anti-gonorrhœal remedies, the advantages are, in every respect, greatly in favor of the balsam of copaiba, especially when perfectly pure, and given in the form of camphor emulsion. What its mode of operating is, or how its remedial effects are produced, is only a matter of conjecture. It is positively certain, however, that it must make a directly medicative impression upon the affected surfaces, as the odor of the balsam is always very apparent in the urine of those who are using it internally, even if it has only been for a short time. Cubebs also seems to exert a direct influence upon the genito urinary mucous membrane, but the benefit arising from its use, both immediate and remote, is, as just stated, much less conspicuous than that which follows the exhibition of copaiba.

Along with copaiba, or copaiba and cubebs, direct medication must be employed; for the time has now arrived when injections are not only useful, but, in some degree, indispensable in order to corroborate and confirm the cure. A numerous catalogue of articles is at the command of the surgeon, from which to make his selection. The most valuable are the different preparations of lead and zinc, sulphate of copper, nitrate of silver, iodide of iron, alum, bichloride of mercury, and tannin, dissolved in soft water, and employed either alone, or variously combined, to suit the exigencies of each particular case. The great precaution which is necessary in their use,

and which experience has taught me is too often disregarded, is to begin with a very mild solution, and gradually to increase its strength as the inflammation subsides, and the urethra becomes more tolerant of the effects of medication. Unfortunately, the opposite of this practice is too often adopted, even by otherwise highly intelligent surgeons, and the consequence is that the foundation is thus but too frequently laid for organic stricture and other serious results, as troublesome to manage as they are distressing and alarming to the patient. A little skill and judgment will usually enable us to avoid this error; for, after all, the proper regulation of injections in the treatment of gonorrhœa is as much a matter of common sense as of a chastened experience. Another excellent practical precept, in relation to this class of remedies, is frequently to vary their employment, substituting one article for another as the former loses its effects, and also reducing or increasing their strength in proportion as they prove either too mild or too severe. I know of no branch of surgery where a practitioner may exhibit his knowledge and judgment, in the treatment of diseases, to more advantage, or in a more favorable light, than in that of gonorrhœa. Sometimes the very best injection, in this stage of the affection, is a grain each of acetate of lead and zinc, to the ounce of water. Another article which I much employ is the iodide of iron, from one-fourth of a grain to half a grain to the ounce of water. The proper strength of the solution of nitrate of silver is from the fourth of a grain to two grains to the ounce of water; of sulphate of copper one-eighth of a grain; of tannin two to four grains; and of alum from one to five grains.

Much of the success of an injection depends upon the manner in which it is administered. In the first place, the syringe should be good; large enough to hold at least an ounce, with a well-working piston, and a long, smooth nozzle. The patient, sitting on a chair or the edge of the bed, inserts the instrument, charged with the lotion, deep into the urethra, the penis being held perpendicularly, and the edges of the meatus firmly pressed against the tube. The fluid is then sent back with some degree of force, so as to reach, if possible, the posterior extremity of the canal, in which it is retained for several minutes before it is allowed to escape. There is no danger of the injection passing into the bladder, or of its causing any harm, if it should do so, as its active ingredients would soon be neutralized by the urine. If the discharge be considerable, the urethra should be washed out previously with tepid water, or, what will answer just as well, the patient should be directed to void his urine a few minutes before each injection.

The frequency of the repetition of the injection must depend upon circumstances. In general, twice a day will suffice, but in some cases it is necessary to perform the operation three and even four times in the twenty-four hours; never, however, unless the fluid is very bland and unirritant. If it cause pain, smarting, or burning, beyond a few minutes, it should either be diluted, or used only once a day. A neglect of this precaution often aggravates the disease and protracts the cure. If the injection is found to disagree, or to prove unavail-

ing, another should be substituted in its stead; for it should be remembered that the urethra, like other parts of the body, has its likes and its dislikes, and that it should always rather be coaxed than forced.

When the disease has reached its third stage, or degenerated into *gleet*, it generally manifests a disposition to linger, or to remain stationary, with, perhaps, hardly any material variation in its character, for many weeks and even months together. It has, as it were, become part and parcel of the mucous membrane, and usually proves extremely difficult to dislodge. It is a case alike annoying to the patient and the surgeon, who often finds his best skill and judgment at fault in finding a suitable remedy. The best plan, under such circumstances, is for both parties to be patient. At all events, it is certain that the disease cannot be taken by storm. As it is chronic, so must the treatment be chronic. Very often success may be obtained by very mild and gentle means; perhaps, simply by attention to the diet and bowels, and by the use of some slightly astringent injection, as a grain each of acetate of lead and zinc to the ounce of water, or the one-eighth of a grain of iodide of iron to that quantity of fluid; aided by a few drops of balsam of copaiba several times in the twenty-four hours. If the patient be plethoric, or at all inclined so to be, he must be freely purged, and take the antimonial and saline mixture, either by itself, or, as I generally prefer, along with a small dose of copaiba; the diet, too, must be very restricted, and stimulants of every kind must be carefully avoided. In a word, the treatment must be partly antiphlogistic, partly specific. If, on the other hand, the patient be weakly, or in need of a better blood, tonics must be given, among which sulphate of iron and quinine occupy the first rank in point of efficacy, about two grains of each, three times daily, constituting a fair average dose. The tincture of the chloride of iron is also a useful article, and one that has almost acquired the title of a specific in the treatment of gleet, although it possesses really no such claim. Its chief value appears to be owing rather to its effects as a tonic than to any particular influence which it is capable of exerting upon the genito-urinary organs. It is often advantageously combined, when there is no contra-indication on account of the state of the stomach, with copaiba, or cubebs; and I have now and then, especially when there was unusual atony of the urethra, given it with marked benefit in union with tincture of cantharides, the proper dose being about twenty drops of the former to eight or ten of the latter, in a suitable quantity of water, every eight hours.

The diet, in these anemic cases, must also be more nutritious, and material benefit is often experienced from the daily allowance of a small bottle of ale or porter, or a small quantity of Holland gin, which, besides invigorating the digestive organs, generally produces a direct and specific impression upon the urinary apparatus. The patient should take gentle exercise in the open air, and use a cool or tepid shower bath, followed by dry frictions, morning and evening. In short, no efforts should be spared to improve the general health. Exercise on horseback is to be interdicted, as it tends to exert a per-



nicious influence upon the affected parts, and, for the same reason, sexual intercourse is to be scrupulously avoided.

The use of cubebs has been highly extolled in the treatment of this class of cases, on the ground of its alleged invigorating effects both upon the part and system. In my own practice, however, I have seldom realized such a result, and I, therefore, long ago ceased to place any confidence in it. If given at all, it should be used in much larger quantities than in the subacute form of the disease.

Along with the remedies above mentioned, I am in the habit of employing, as a local application, the dilute tincture of iodine, in the proportion of one part to four or five of alcohol, pencilling with it the whole under surface of the penis, in the direction of the urethra, twice a day. Of all the topical measures that I have ever used in the treatment of this affection, I know of none that is so efficacious as this in dislodging the specific inflammation from the mucous follicles, where it frequently lingers long after it has left the main surface of the lining membrane. On one occasion, I effected a prompt cure of a gleet of nine months' standing, with the application of a narrow blister along the course of the urethra; the remedy, however, is very severe, and few patients will submit to its employment. Cantharidal collodion would make a better application than an ordinary epispastic.

When gleet proves very obstinate, resisting all the ordinary means, however judiciously or perseveringly employed, a speedy termination may often be put to its progress by the use of *heroic* injections, consisting of from twenty to thirty grains of nitrate of silver to the ounce of water, and introduced into the urethra every twelve hours, until there is a free sanguinolent discharge with severe scalding in micturition. In some cases one solitary injection of this kind will suffice to break up the specific disease, but most generally the operation is obliged to be repeated two or three times before the desired object is attained. However this may be, the treatment is to be followed by injections of some mucilaginous fluid, warm applications to the parts, rest, a full anodyne, and light diet; otherwise the new inflammation might readily extend to the bladder and testes. Instead of the nitrate of silver, I have witnessed excellent effects from the use of tincture of iodine, in the proportion of twenty-five or thirty drops to the ounce of water, employed in the same manner.

I have said nothing, in these remarks, respecting the employment of medicated bougies in the treatment of gleet, so much vaunted by certain practitioners. I have the more willingly passed them by, because I am satisfied that their value has been greatly exaggerated, and that all the good they are capable of doing may readily be effected by the use of injections.

Finally, whatever measures be adopted for the relief of gonorrhœa, considered in reference to all its stages and grades of character, it is a matter of paramount importance, in regard to the permanent cure of this disease, that the treatment should be continued, uninterruptedly, for at least six or eight days after all discharge has apparently ceased. If this precaution be neglected there is always great danger of a speedy

return of the disorder, thus compelling both the patient and practitioner to go through the same, or a similar course.

The treatment of the *local complications* of gonorrhœa must be conducted upon general antiphlogistic principles, modified by the peculiar character of each affection. With the exception of chancre, they are to be viewed, not as independent lesions, but as maladies owing their existence entirely to the gonorrhœa, or to the specific inflammation of the mucous membrane, of which, in fact, most of them are merely a continuation.

The *chordee*, which is often such a very troublesome symptom, usually disappears with the inflammation which causes it; hence, antiphlogistics are always the most suitable remedies for combating it radically. But immediate or temporary relief is best secured by antispasmodics, especially morphia and tartarized antimony, a grain of the former and one fourth of a grain of the latter being given towards bedtime. Under the influence of this prescription the patient soon falls asleep, copious diaphoresis ensues, and a tranquil night is passed. The same object may generally be readily attained by an opiate suppository, or by an enema of a drachm of laudanum, or of this quantity of laudanum and twenty grains of camphor, dissolved in alcohol, and mixed with some mucilaginous fluid. If the parts are hot and violently excited, they should be covered with cloths wrung out of cold water, and frequently renewed.

The induration of the spongy structure of the urethra, caused by the deposition of plastic matter, will gradually disappear under the steady use of mercurial inunctions and sorbefacient lotions, aided by the exhibition of an occasional dose of blue mass, or a minute quantity, thrice a day, of bichloride of mercury.

*Cystitis* usually readily yields to leeches to the perineum, the warm hip-bath, hot fomentations to the hypogastrium and genitals, and full anodynes with tartarized antimony, to allay spasm of the organ and promote relaxation of the system. In plethoric subjects the lancet may be required. If retention of urine take place, and antispasmodics fail to afford relief, the catheter must be used, but it should by all means be avoided if the object can be attained without it.

If *epididymitis* be present, the lancet, or, at all events, leeches will be required; the bowels are opened with a brisk cathartic, and free use is made of the saline and antimonial mixture, administered in such a manner as to keep up decided nausea. Starvation and perfect rest are enjoined; and the affected organs, carefully suspended, are kept constantly wet with a solution of acetate of lead and tincture of opium, applied either warm or cold, as may be most agreeable to the part and system. No attempt is made by direct medication to re-invite suppressed discharge; as the inflammation subsides this will be sure to return of its own accord, and that without risk of bad consequences. Slight ptyalism may be necessary to rid the glandular structure of induration and swelling; and a careful supervision must be exercised over the general health for a long time to come.

*Bubo* is treated antiphlogistically; by rest in the recumbent posture, active purgation and light diet, and by the application of iodine and

emollient cataplasms, medicated with acetate of lead and tincture of opium.

The *hemorrhage* which occasionally attends this disease is seldom so copious as to require special interference; when it does, it will generally be found to yield very promptly to applications of pounded ice in a bladder, aided by compression with the compress or the catheter. Acetate of lead and morphia may be given internally.

The co-existence of *chancre* with gonorrhœa always constitutes a serious complication, tending to perpetuate the inflammation, and to endanger the constitution by the absorption of the syphilitic poison. The principal local remedies are, the application of dilute tincture of iodine over the site of the chancre, the use of emollient poultices, and frequent injections, at first of tepid water, and afterwards of tannin and red wine, yellow wash, or a weak solution of nitrate of silver. If the chancre is hard, or difficult to heal, a mild course of mercury will probably be required; and it is astonishing how rapidly, under this treatment, the disease usually subsides. All harsh and irritating applications are, of course, out of the question.

*Abscesses*, forming along the course of the urethra or perineum, are to be managed upon the same general principles as abscesses in other parts of the body; antiphlogistically in the first instance, and by free incision afterwards, yet sufficiently early to anticipate serious destruction of tissue and the development of urinary fistule.

For the cure of *balanitis* very simple treatment is generally sufficient. The patient is purged with some cooling medicine, and kept at rest, on a restricted diet, while the parts are frequently bathed with cold or tepid water, and covered, in the interval, with an emollient poultice, or medicated dressings. If the foreskin is too narrow, or too much swollen, to admit of retraction, the use of the syringe will become necessary, simple water, or some gently astringent lotion, as a solution of acetate of lead, or Goulard's extract, being frequently thrown into the preputial bag, both to promote cleanliness and stay inflammation. Harsh and irritating applications are carefully abstained from. In many cases prompt improvement follows the injection of a solution of tannin and opium in water and red wine. In the chronic form of the disease the use of a very dilute ointment of the nitrate of mercury often rapidly conduces to a cure. Keeping the inflamed surfaces in a state of isolation by the interposition of a piece of soft lint always exerts a salutary influence, and greatly expedites recovery.

#### SECT. VII.—NON-SPECIFIC URETHRITIS.

The male urethra is sometimes the seat of a non-specific discharge, so closely simulating that of gonorrhœa as to render it very difficult, if not impossible, to distinguish between them, especially when it occurs in married men. It has been supposed that such a disease might be contracted during intercourse with women laboring under leucorrhœa, and other ordinary utero-vaginal affections, and this is probably the fact, the occurrence being the more likely to happen when there exists an un-



usual proclivity on the part of the urethra to inflammation. A mucopurulent discharge of this canal is occasionally met with in young men, independently of sexual intercourse. I am acquainted with a highly intelligent physician who seldom fails to suffer in this way whenever he labors under dyspepsia, or an attack of hemorrhoids, to both of which he is rather subject. On several occasions the discharge has been coincident with an attack of rheumatism. Children are sometimes affected in a similar manner. Last May, Dr. Bournonville, of this city, sent to me a male infant, seven months old, from whose urethra there had been more or less of a mucopurulent discharge for upwards of a month. The child had become affected, soon after its birth, with eczema, but this had long ago disappeared, and at the time I saw him he was quite stout and robust. I recollect a boy, between three and four years of age, in whom the disease existed in a marked degree for a number of weeks, and still another, nearly ten years old, in whom the discharge could not have been more thick and profuse, if he had labored under genuine gonorrhœa. Such attacks have their analogy in the vaginal profluvia of little girls.

Simple urethritis is most commonly met with in unhealthy, delicate children, predisposed to cutaneous disease and disorder of the digestive apparatus. Occasionally, it can be traced to the irritation of worms in the alimentary canal, to stone in the bladder, or organic lesion of the anus and rectum, as ulceration and hemorrhoids.

However induced, the *symptoms* do not differ essentially from those of gonorrhœa. In general, the disease is ushered in by a peculiar itching, or stinging sensation, rapidly followed by heat in the part, unnatural redness of the meatus, and slight scalding in passing water. The discharge is at first thin and gleet, like the white of egg, but it soon becomes mucopurulent, thick, yellowish, and quite abundant. When it follows upon sexual intercourse, it generally sets in within the first twenty-four hours.

The most reliable *diagnostic* circumstances are, the history of the case, the age of the patient, the suddenness of the attack, the comparative smallness of the discharge, and the facility with which the disease yields to treatment. When such an affection occurs in a married man, or in a man accused of rape, the surgeon cannot be too cautious in the expression of his opinion respecting its true character.

In some cases the disease is quite obstinate; in others, on the contrary, it either soon disappears of its own accord, or it yields to very mild remedies. Diligent inquiry should always be made into the nature of the exciting cause. The general health must be amended, cooling laxatives must be given, and the utmost attention must be paid to cleanliness. If these means do not speedily effect a cure, recourse is had to the administration of copaiba, and the use of astringent injections, in the same manner as in true gonorrhœa. When tonics are required, the best articles will be iron and quinine, with nux vomica. Should the discharge be connected with a rheumatic state of the system, the exhibition of colchicum will be indicated.

## SECT. VIII.—SPERMATORRHŒA.

A loss of semen is one of the natural consequences of manhood ; it is a necessity of the system, and is, therefore, to be regarded as a disease only when it occurs too frequently, or when it is provoked by improper means. When this is the case, it may be followed by the most deplorable results, both bodily and mental.

The great cause of this disorder is masturbation, but it may also be produced by excessive venery, gonorrhœa, stricture of the urethra, stone in the bladder, hemorrhoids, fissure of the anus, the presence of ascarides, and disease of the cerebellum. The irritation on which it more directly depends is seated at the neck of the bladder, the ejaculatory ducts, and the seminal vesicles, the mucous membrane of which is in a state of morbid sensibility similar to what is occasionally witnessed in the eye, nose, and fauces. Masturbation is a common vice among youth, and, once established, is liable to be followed by the most serious consequences, both as it respects the health and the happiness of the individual. At first, the emissions are strictly voluntary ; they take place under the influence of a lascivious dream, or an excited state of the brain, and are attended by the usual feeling. By and by, however, as the local irritation increases, they occur without sensation, and without consciousness, either during sleep, or while the patient is at the water-closet. When the habit is fully established, there may be five or six discharges a week, or even as many as two or three in the twenty-four hours. The disease may continue in this state for years, without any decided abatement. The seminal fluid itself, although secreted in preternatural quantity, is without ropiness, very thin, and characterized by a strong odor.

It is hardly to be expected that an affection which keeps up such a constant drain upon the system, should continue long without seriously disturbing the general health. Among the earlier symptoms denotive of this circumstance, is derangement of the digestive organs, attended with constipation of the bowels, occasional headache, and nervous tremors. At a more advanced period, the patient is harassed with palpitation and dizziness, his sleep is disturbed at night, his extremities are cold, his body exhales a peculiar seminal odor, he shuns society, and he becomes a prey to gloom and despondency. The erections are imperfect, the testes waste, and there is a feeling of numbness or coldness of the thighs, scrotum, and perineum. Impotence, more or less complete, is one of the most common effects of this disorder in protracted cases. When the disease is thus fully established, the patient suffers under loss of memory, his actions are those of a poltroon, he has no longer any faculty for business, and he is unable to look any one in the face. In a word, he is mentally and physically emasculated.

The *treatment* of this affection should be commenced as early as possible ; for the longer it is deferred the more danger will there be of permanent impotence and wretchedness. The milder cases, after ridance of the exciting cause, often get well spontaneously, or under the use of very mild means, as a proper regulation of the diet and

bowels, exercise in the open air, cold bathing, and sleeping upon a hard mattress. When the parts are morbidly sensitive, leeches may be applied to the perineum, and recourse be had to some astringent and anodyne injection, such as a solution of acetate of lead and opium, in the proportion of three grains of each to the ounce of water, used twice a day. But a very different mode of management will be required when the disease is fully established, especially when it is dependent upon habitual onanism. The best local remedy, under such circumstances, is cauterization; without this, in fact, nothing can be done with a prospect of a radical cure. Before resorting to the caustic, the urethra should be well explored with a bougie, or silver catheter, to ascertain the precise seat of the irritation. This will sometimes be found in front of the membranous portion of the urethra, but, in general, it is farther back, at the neck of the bladder, or, more properly speaking, at the orifices of the ejaculatory ducts and the anterior extremity of the gallinaginous crest, and is often so great that the patient shrinks from the mere contact of the instrument. Occasionally the morbid sensibility is diffused over the whole surface of the urethra, from one end to the other, and when this is the case the passage of the bougie is liable to be followed by excessive pain and even syncope. When the seat of the irritation has been ascertained, the caustic—a bit of nitrate of silver, inserted in the instrument sketched at page 914—is to be conveyed down to the requisite distance, and held there from five to ten seconds, when it is cautiously withdrawn, the object being merely an antiphlogistic effect. Carried beyond this, the remedy becomes a cause of abuse, likely to be followed by harm instead of benefit.

When the cauterization is finished, the patient is requested to drink a tumblerful or two of gum water, with a small quantity of spirit of nitric ether, and to observe the antiphlogistic regimen. If the pain is considerable, or if strangury supervene, a drachm of the camphorated tincture of opium, or half a grain of morphia, may be taken. I usually repeat the operation once a week until I have reason to believe that the morbid sensibility of the part is entirely destroyed. The number of applications must, of course, vary in different cases, but, in general, from two to five will suffice.

Cold bathing, general and local, is often beneficial in this affection. Sitting in a tub, and dashing the cold water against the perineum, scrotum, penis, and inside of the thighs is useful. In some instances I have found marked relief from cold enemata, repeated twice in the twenty-four hours. When the patient is plethoric, as is sometimes the case in the early stage of the disease, leeches may be applied to the perineum, followed, if the local excitement is unusually great, by blisters, tartar-emetic frictions, a small seton, or an issue. When the morbid sensibility of the urethra is very extensive, obstinate, or persistent, the cauterization should be aided by the injection, twice a day, of a weak solution of nitrate of silver and opium. The proportions which I commonly employ are two grains of one and a grain and a half of the other to the ounce of water. Sulphate of zinc, creasote, and acetate of lead, also answer extremely well in cases of this kind. The injection should be forced as far back as possible, and be retained two or three minutes in the canal.



A total abandonment of masturbation, and temporary abstinence from sexual intercourse, are indispensable measures. Without this it is in vain for the surgeon to proceed with his treatment. The patient must sleep upon a hard mattress, and everything stimulating, whether in the form of food, drink, or medicine, must be carefully avoided. The bowels must be regulated by mild aperients, and on no account be allowed to become constipated. Exercise in the open air, either on foot or in a carriage, is an important auxiliary. Riding on horseback is to be interdicted, as it has a tendency to create undue excitement in the genital apparatus. Sometimes an entire change of occupation affords more relief than anything else.

When there is great prostration of the system, with restlessness and loss of sleep, tonics, such as quinine, and the aromatic tincture of the citrate of iron, with hyoscyamus or opium, are indicated. In such cases, a change of air, and the daily use of the shower-bath, greatly promote recovery. The diet should be light, but nutritious, and the patient should be allowed a glass of generous wine at dinner. Should there be reason to believe that the emissions are dependent upon cerebellar irritation, our chief reliance must be upon leeches and blisters to the nape of the neck, the cold shower-bath, and the exhibition of sedatives. Much has lately been written in favor of lupulin, as a sedative, in this disease; but, although I have frequently employed it, I do not think it has ever done any good in my hands. When such a remedy is required, the best article that I know of is bromide of potassium, given three times a day, in doses varying from ten to twenty grains, in union with five drops of tincture of aconite, and half an ounce of camphor water.

When, by the above measures, the system has regained its natural tone, and the sexual apparatus its accustomed vigor, the best guarantee against relapse will be marriage. Upon this point, however, the practitioner cannot be too much upon his guard.

The practice of onanism often engenders a want of confidence, in young men, in regard to their ability to consummate the marriage contract. In fact, it renders them sometimes temporarily impotent. I have repeatedly known this to be the case after the marriage had taken place, much to the annoyance both of the patient and the surgeon. In general, however, the defect is rather in the mind than in the body, and may easily be corrected by entire abstinence for several weeks, and by the use of a little medicine, such, for instance, as a few drops, three times daily, of equal parts of tincture of nux vomica, chloride of iron, and cantharides, with the assurance of speedy recovery. In this way confidence is restored, and the difficulty, of course, soon vanishes. Occasionally the obstacle is caused by too great an eagerness on the part of the individual, or by too frequent indulgence soon after marriage. At other times, again, the erections are imperfect, or the act is prevented by a premature emission. These effects frequently subside of their own accord; when they do not, an attempt should be made to correct them by a judicious course of treatment, especially the use of tonics, the shower-bath, and attention to the bowels and secretions, aided, if the parts be morbidly sensitive, by cauterization of the urethra, and mildly astringent injections.

## CHAPTER XVII.

## DISEASES AND INJURIES OF THE FEMALE GENITAL ORGANS.

## SECT. I.—AFFECTIONS OF THE UTERUS.

THE uterus is liable to displacement, inflammation, hypertrophy, various kinds of tumors, and carcinoma. Before I proceed to describe these affections, it will be necessary to offer some remarks respecting the proper mode of ascertaining their existence, or, in other words, the most suitable mode of examining a woman when she is suspected to be laboring under uterine disease.

## EXAMINATION OF THE UTERUS.

When the object is to ascertain the position of the womb, the exploration should be effected with the finger, well oiled, and introduced into the vagina, as the woman is standing up before the surgeon, who supports himself upon his knee, or sits on a low stool. In this manner, the finger, moved about in different directions, readily detects any displacement, whether it affects its neck, body, or fundus. If the patient be requested to cough while in this posture, the effect produced by the concussion of the diaphragm and abdominal muscles upon the dislocated viscus is easily appreciated, at the same time that any change in its bulk may be ascertained by the touch, as this variety of exploration is called, and also the extent and degree of the morbid sensibility that may exist. The examination will always be more satisfactory if the bowels be previously well opened. Very frequently important information may be acquired by the introduction of the finger into the rectum. Retroversion of the uterus, ovarian dropsy, and various pelvic tumors, are often better diagnosticated in this way than in any other.

When the design is to inspect the mouth and neck of the uterus, or this organ and the vagina, the patient is placed upon her back, across the bed, her feet resting upon its edge, where the breech should also be, the limbs being raised and widely separated from each other. A sheet, with a small hole in the centre, is thrown over the person, which must never be exposed in any case. Some practitioners prefer that the patient should lie on her side, close to the edge of the bed, with the limbs well flexed upon the pelvis, and the body somewhat doubled up. Whatever posture be adopted, it is highly important that there should be a clear light, and it need hardly be added that that of the sun is superior to an artificial one. The index and middle

fingers of the left hand are placed against the orifice of the vagina, near its superior extremity, when the speculum, properly warmed and oiled, is gently and slowly passed along the tube as high up as the mouth of the uterus, which, if not too large, often projects directly into it, thus affording a complete view of its condition. The speculum which I have long been in the habit of using is the cylindrical (fig. 535), about six inches in length, and of a slightly conical shape, to facilitate its introduction. In order to meet the various contingencies that arise in practice, several such instruments, of progressively increasing size, should be at hand. The valvular speculum, represented in fig. 536, although generally objectionable, because it admits of the intrusion of the mucous membrane of the vagina, may advantageously be used in certain displacements of the uterus, especially in retroversion. Professor Miller, of Kentucky, prefers a cylindrical speculum, bevelled at each extremity, in opposite directions, so as to shorten one of its sides, which is turned towards the pubes, during the introduction; an arrangement, which, it is alleged, not only admits more light, but affords easier access to the mouth of the organ.

Fig. 535.

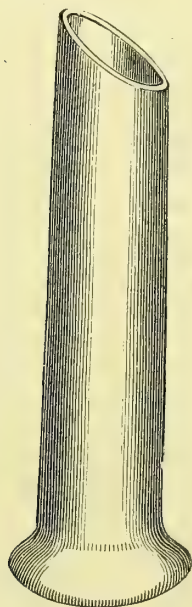
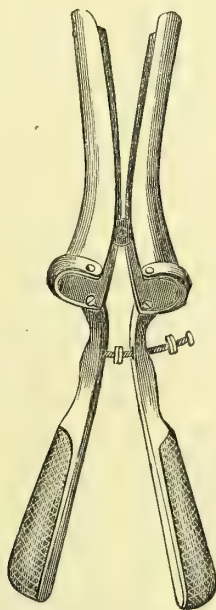


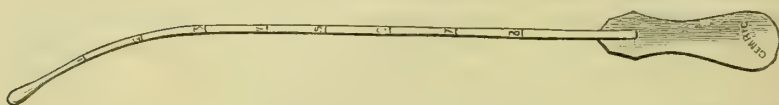
Fig. 536.



Whatever instrument be used, a proper probe should always be at hand; for ordinary purposes, none answers better than the one delineated at page 523; but when the object is to explore the cavity of the uterus, or to replace this organ, Simpson's sound (fig. 537) should be selected, or that recommended by Dr. Miller, which is a good deal more curved than that of the Scotch obstetrician, and, therefore, better adapted to the rectification of some of the malpositions of the viscus.



Fig. 537.



Another contrivance that will be found of great service, is a soft sponge-mop, for wiping away the secretions, so as to afford a clearer view of the affected structures.

When it is necessary to apply *leeches* to the uterus, or the upper portion of the vagina, the object may readily be accomplished by placing the animals in the speculum, the parts having previously been well cleaned with water. The number of leeches to be used must vary according to the amount of the morbid action, and the condition of the general system. A good average is from three to five, which often cause a very copious flow, the bleeding frequently continuing for many hours after the animals have dropped off.

The most common *caustic*, or, rather, antiphlogistic applications that are made to the uterus are nitrate of silver, either in substance, or solution, and acid nitrate of mercury, either pure, or weakened. To insure efficiency to these applications, they should be made with the aid of the speculum, directly to the affected surface, care being taken not to use them too freely, too often, or too strong. The lightest possible touch frequently answers the purpose of an antiphlogistic agent. When the actual cautery is employed, a wooden speculum will be necessary, to protect the parts from the heat, and to prevent the fluids from coming in contact with the vagina.

Perfect cleanliness of the uterus and vagina, in disease, can only be secured by the use of the *syringe*, of which there are a great many before the profession; few, however, that combine all the necessary qualities of such an apparatus. To answer the purpose properly, the instrument should be capable of holding at least from ten to twelve ounces; the nozzle should be long and curved, and perforated with numerous foramina, after the fashion of the common watering-spout. The injection may be administered by the patient herself, as she lies on her back, over a bed pan, or while she is sitting up, care being taken to use considerable force, in order to bring the fluid, which may either be simple or medicated, in contact with every portion of the affected surface.

#### MALPOSITIONS.

Of the various malpositions to which the uterus is liable, the most common are retroversion, anteversion, prolapse, and inversion.

a. In *retroversion* (fig. 538), the orifice of the uterus is tilted up against the pubic symphysis, the fundus being thrown downwards and backwards, so as to form a tumor between the vagina and the rectum. Thus the axis of the organ is totally reversed relatively to its natural situation within the pelvis. The displacement is very

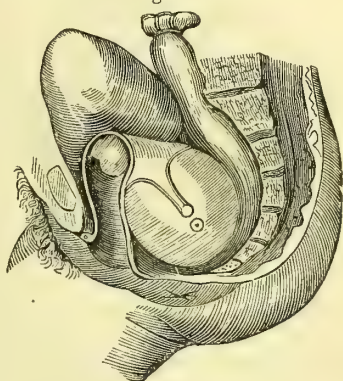
common in the unimpregnated state, and is also occasionally met with during pregnancy, especially between the third and fourth months. It generally occurs in consequence of the relaxation of the ligaments of the uterus, and of the engorged condition of this organ, rendering it, as it were, top-heavy, and thus favoring its descent against the rectum. For these reasons, the accident is often met with soon after delivery, at a time when the body of the uterus is unusually large and vascular, and, therefore, incapable of sustaining itself in its natural position.

Retroversion of the womb is attended with a feeling of weight and dragging in the pelvis and groins, pain in the sacro-lumbar region, frequent desire to pass water, with almost constant uneasiness in the bladder, and difficulty in defecation. The general health is variously affected, and there is usually more or less leucorrhœa. In the worst forms of the disease, the patient often suffers from retention of urine. The retroverted organ is always easily detected with the finger, its orifice lying just behind the pubic symphysis, while the body forms a hard, globular mass, resting upon the lower part of the rectum. The affection is liable to be confounded with abscess of the pelvis, polyp of the uterus, ovarian tumors pressing down the posterior wall of the vagina, and stricture of the lower bowel.

Inasmuch as this displacement is frequently, if not generally, essentially dependent upon engorgement of the uterus, the *treatment* must obviously be of an antiphlogistic character, consisting of rest in the recumbent posture, light diet, astringent and cooling injections into the vagina and rectum, and the application of leeches to the hypogastric and sacro-lumbar regions. If the woman be very plethoric, and the retroversion occurs soon after delivery, bleeding at the arm, followed by a brisk cathartic, will be useful. Under this management, the organ not unfrequently slips back into its natural position of its own accord. When there is much discharge, it may always be regarded as an evidence of inflammation of the uterus, or of this organ and the vagina, and the case should, therefore, be treated accordingly; that is, by leeches and nitrate of silver to the affected parts.

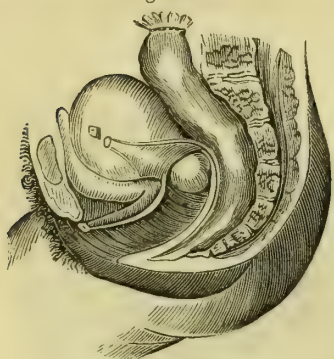
Reposition is effected by the uterine sound, carried into the cavity of the womb, and by pressure against the body and fundus of the viscus with the finger in the vagina or rectum. In the milder cases of displacement, the reduction may often readily be effected through the agency of the colpeurynter, carried high up into the vagina, and then forcibly distended with air or water. When the uterus has become firmly adherent to the surrounding parts, the disease may be regarded as irremediable, though considerable relief may follow the use of the pessary.

Fig. 538.



Retroversion of the uterus.

Fig. 539.



Anteversion of the uterus.

*b. Anteversion* (fig. 539) is a displacement precisely the reverse of the preceding, that is, the fundus of the womb is carried forwards on the urinary bladder, and the mouth backwards towards the rectum and the hollow of the sacrum. It rarely occurs during pregnancy, and is almost always associated with hypertrophy of the uterus. The anteversion is sometimes produced by morbid adhesions between the organ and the peritoneum, which have the effect of forcing it out of its normal position.

The *symptoms* of anteversion are often quite obscure, especially in the earlier stages of the complaint. Most women, however, thus affected, experience more or less distress, as a sense of weight and bearing down, in the pelvis, and dull, heavy, aching pains in the lower part of the back. Leucorrhœa also usually exists, and there is often marked disorder of the general health, as shown by various nervous and anomalous phenomena. The bladder is sometimes seriously incommodated by the pressure of the dislocated organ, and similar inconvenience is occasionally experienced by the rectum, though seldom to the same extent as in retroversion. The precise nature of the affection is always readily distinguished by digital examination.

The *treatment* must be conducted upon the same general principles as in retroversion. If the dislocation depends upon engorgement of the uterine tissues, the remedies must be of an antiphlogistic character, conjoined with strict recumbency. Restoration is generally readily effected with the sound and finger, while counter-pressure is made upon the body and fundus of the uterus over the lower part of the hypogastrium.

In both of the above forms of displacement, the patient should observe recumbency for several weeks after the reduction, and, for a long time, pay great attention to her bowels and diet. Immediately after the operation is over, she should put on a uterine supporter, which should never be left off for a moment, when she is in the erect posture, until there is reason to believe that the parts have entirely regained their original functions.

*c. The uterus is liable to prolapse.* Notwithstanding that it has four ligaments which serve to maintain it in its natural position, it not unfrequently, both in its empty and gravid state, loses its hold and falls down into the vagina, and even beyond the vulva. In the latter case, the organ forms a tumor between the thighs, with a small, central aperture corresponding to its mouth, and the vagina is completely inverted, or pulled inside out. The accident is always attended with a thick muco-purulent discharge, a feeling of weight in the pelvis, dragging sensations in the groin and hypogastrium, pain in the sacro-lumbar region, and disorder of the general health. It may be produced by mere relaxation of the parts, with an engorged condition of the uterine tissues, but generally the immediate cause is a severe strain.



For the milder forms of prolapse, the most suitable *remedy* is the constant use of a well adjusted supporter, the pad, which should be rather broad, and of an ovoidal shape, resting upon the hypogastrium, so as to hold up the abdominal viscera, and thus prevent them from pressing too much upon the womb. The instrument need not be worn at night, but it should always be put on in the morning before the patient gets out of bed. When the disease exists in a very aggravated degree, it may be necessary, in addition, to make the patient wear a pessary, but such an instrument should never be employed if it be possible to avoid it, as it often, of itself, becomes a source of great inconvenience, if not positive suffering, by inducing inflammation and even ulceration in the parts with which it lies in contact. In most cases of prolapse, great benefit will accrue from the steady use of astringent injections, a soluble condition of the bowels, a concentrated diet, and rest in the recumbent posture, with the frequent application of leeches to the neck of the uterus. When the womb protrudes beyond the vulva, the only alternative is either to attempt restoration by means of the stem pessary, or by permanent closure of the greater portion of the vagina by suture of its opposed surfaces. The latter operation, known by the name of *episoraphy*, has proved successful in a number of instances, and is quite free from danger. It consists in removing several longitudinal slips of mucous membrane, and in tacking the edges of the wound together with the needle and thread. When the case cannot be remedied in this wise, we may adopt the practice of Professor Geddings, and close the orifice of the vagina nearly entirely by paring the surfaces of the labia, and uniting them with the interrupted suture.

d. In *inversion* of the uterus, the viscus is turned inside out. It is generally attended with more or less prolapse of the body of the organ, and seldom happens except during delivery of the after-birth, or the forcible removal of some tumor from its interior. Of this lesion there are three degrees. In the first, the fundus falls down nearly to the mouth of the womb, where it is arrested; in the second, it passes beyond this point for half or more of its length; in the third, the whole organ escapes at the inferior orifice. In the second case, it is obvious that the body and fundus may be compressed, or strangled, by contraction of the neck. The complete form of inversion of this organ is well shown in the annexed drawing (fig. 540), from a preparation in the possession of Professor Meigs.

The *treatment* of this affection must be prompt and decisive. In its milder forms, reduction, if attended to immediately after its occurrence, is occasionally effected without difficulty; but when the inversion is com-

Fig. 540.



Inversion of the uterus.

plete, especially if it has existed for some time, the operation is rarely, if ever, successful. The efforts at replacement will be more likely, other things being equal, to be successful, if the patient be perfectly anæsthetized. In performing the operation, the organ should be firmly grasped and equably compressed, so as to squeeze out its blood. Without relaxing his efforts, the surgeon then carries it up into the vagina, which will now become tense, and thus re-invert the mouth of the uterus, a most important element in the restorative process. The pressure being steadily continued, the body of the uterus becomes gradually shorter and shorter, the resistance at its neck progressively diminishing, until, eventually, the parts resume their natural position. For this method of treatment, which is as simple as it is ingenious, the profession is indebted to Professor Quackenbush, of Albany, New York. He has himself succeeded with it in one case, and in the paper published by him on the subject he refers to two others, relieved by a similar procedure; one by Dr. J. P. White, of Buffalo, of fifteen years' standing, and the other by Dr. Tyler Smith, of London, of nearly equal duration.

In reflecting upon the nature of this affection, it has occurred to me that the reduction, especially in cases of long standing, might be greatly expedited by a slight vertical incision on each side of the neck of the tumor, where the chief cause of the difficulty is situated, the principle being the same as in the operation for paraphymosis.

When the tumor is hopelessly irreducible, it is not only a source of mechanical inconvenience, but of almost incessant hemorrhage, draining the system of blood, and keeping the woman constantly at death's door. Under such circumstances, as a dernier resort, amputation is occasionally practised. The operation, however, is generally fatal, the patient dying from shock, hemorrhage, peritonitis, or pyemia. In a case in my hands, some years ago, death occurred in less than forty-eight hours from inflammation, and in another in which I assisted Professor Miller, the woman perished from hemorrhage in less than three hours. From the results of these two cases, I should certainly have no desire to repeat the operation.

#### INFLAMMATION.

The uterus is liable to inflammation, both in the married and in the single female, but much more frequently in the former than in the latter. The disease may attack any portion of the organ, or it may be limited to the lining membrane, the parenchymatous substance, or the peritoneal covering, or all these structures may be involved simultaneously, together with the venous and absorbent trunks.

Inflammation of the *lining membrane* is characterized by the same phenomena that are observed in inflammation of the mucous textures in other parts of the body. The redness, which is of a deep shade, is often spread over a large extent of surface, and may, in violent cases, be accompanied by small ecchymoses, with an escape of blood on pressure. The mucous follicles, especially those about the mouth of the uterus, are in a state of enlargement, and there is usually a very

marked increase of the natural secretion. In some instances, pus is deposited, and continues to be discharged for a considerable period. An effusion of plastic matter is also sometimes observed, but chiefly when the disease invades the body of the organ.

*Ulceration* of the uterus may occur at any period of life after puberty, but is most common between the ages of thirty and forty, in married women. It usually attacks the lips and neck of the organ, and exhibits every variety of form, from the slightest abrasion, merely involving the mucous lining, to a cavity several lines in depth. The resulting sore may be of a circular, oval, or linear shape. In many cases it has the appearance of a crack, chap, or fissure, lying longitudinally or obliquely upon the surface of the affected lip or neck. Its edges are sometimes very abrupt, giving the part the appearance as if a depression had been made into it with a punch. The bottom of the ulcer is smeared with unhealthy pus, incrustated with lymph, or studded with granulations, of varying size, color, and consistence. The surrounding structures are red, tender, and often quite indurated. In cases of long standing, or unusual severity, the lower extremity of the uterus is excessively engorged, considerably enlarged, and greatly altered in its figure, often exhibiting a knobbed, clubbed, or pouting appearance. In some cases, the affected structures, instead of being indurated, are abnormally soft, or hard at one point and soft at another. In the more aggravated forms of ulceration, the organ increases in its weight, and thus becomes a cause of its own prolapse, by its dragging effects upon its ligaments.

The *discharge* which accompanies the ulcerative action is subject to the greatest possible variety, both as it respects its quality and quantity. Thus it may be thick and yellow, thin and sanious, bland or irritating, scanty or abundant, free from odor or more or less fetid. In general, it is mixed with considerable mucus, of a thick, ropy character.

Ulcers of the uterus may be acute or chronic, simple or specific. The simple ulcer usually arises without any assignable cause, and often continues for months and years, making, perhaps, in the meantime, very little progress. The syphilitic ulcer is usually distinguished by its excavated character, its spreading tendency, and the copper-colored appearance of the adjacent parts.

Inflammation and ulceration of the uterus often co-exist with vaginitis. The *symptoms* are frequently vague and uncertain. The most important and reliable are, a discharge of thick, yellow, purulent, or muco-purulent matter, a feeling of weight and fulness in the lower part of the pelvis, tenderness on pressure of the hypogastrium, pain and aching in the sacro-lumbar region, and dragging, sickening sensations in the groins and back, especially during exercise. The general health, at first unaffected, is sure to suffer as the disease progresses. The menstrual function is apt to be disordered; and, although conception is not impossible, even when there is considerable ulceration, yet a female thus affected is extremely liable to abort or miscarry. When the inflammation and ulceration are of long standing, the uterus becomes enlarged, more or less engorged, and subject to various kinds



of displacements. The diagnosis of the disease can only be satisfactorily determined by a thorough exploration with the speculum.

The *treatment* of inflammation of the mucous membrane of the uterus, in its milder forms, is generally very simple, the disease usually promptly yielding to the ordinary antiphlogistic remedies, as light diet, an active purge, recumbency for a short time, and injections of acetate of lead, Goulard's extract, alum, or zinc. If the disease is obstinate, or complicated with ulceration, a few leeches may be necessary, followed by the application of the solid nitrate of silver, or, what I prefer, the dilute acid nitrate of mercury, repeated once a week, the parts being in the meantime daily syringed with cool or tepid water, medicated with some astringent substance, as, for example, one of those just mentioned. When leeches cannot be obtained, recourse is had to scarification. If the caustic be used too often, or too freely, harm instead of benefit will result, and the case will be much longer in getting well. The patient should be rigidly recumbent during the treatment, the bowels should be maintained in a soluble condition by salts or magnesia, or cream of tartar and jalap, and the diet should be light and simple. Sexual intercourse is, of course, prohibited. If this treatment be faithfully carried out, recovery may confidently be looked for in from six to eight weeks, even in the worst cases.

A *granular* condition of the neck and mouth of the uterus occasionally exists, the mucous membrane being thickly studded with bodies similar to those which are so frequently found on the eyelids. The disease is generally a consequence of chronic inflammation, and is always attended with more or less muco-purulent discharge. The best local remedy is chromic acid, used in the same cautious manner as when applied to warty excrescences of the penis and vulva, repetition being effected every fourth or fifth day.

Another effect of chronic inflammation of the uterus is an extraordinary development of its *mucous follicles*. The disease is most conspicuous about the mouth and lips of the organ, where the glands are sometimes as large as a hemp-seed, or even a small pea, dense, almost gristly, and of a white, grayish color. The parts between them are generally tumid, red, morbidly sensitive, and disposed to bleed. In several cases, I have seen the enlarged glands transformed into considerable cysts, filled with a pale, tremulous substance, easily removed by pressure. The appearances of these enlarged follicles, in the different stages of their progress, are well shown in fig. 541 and fig. 542. The disease is always attended with induration and thickening of the neck and lips of the uterus and a tolerably profuse discharge of muco-purulent matter.

The most effectual remedy in this disease is repeated and thorough scarification of the affected structures, aided by leeching and the application of solid nitrate of silver, or, what I have generally found more beneficial, the pure tincture of iodine.

Inflammation of the *body* and serous covering of the uterus is most common in females during the first eight or ten days after parturition. It sometimes betrays an epidemic tendency, and rapidly passes into suppuration, softening, or even gangrene. The pus that is poured

Fig. 541.

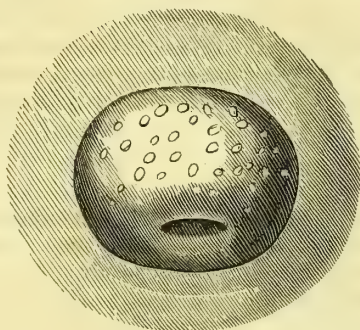
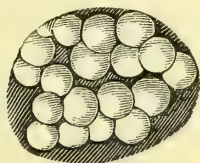


Fig. 542.



out, in such cases, may be situated in the parenchymatous structure, in the uterine cavity, the subserous cellular substance, between the folds of the broad ligaments, or, finally, in the venous and absorbent trunks, or simultaneously in all these parts. In most of these localities it occurs in the form of small yellowish-looking globules; but cases are observed in which it is collected into distinct abscesses, which are, however, never very large, and which manifest a disposition, sooner or later, to burst into the vagina, the rectum, pelvis, or urinary bladder. The pus is generally blended with a good deal of lymph, and is sometimes highly offensive.

The lesion may originate in, and be limited to, the veins, constituting what is called uterine *phlebitis*; in the great majority of cases, however, the parenchymatous structure participates in the inflammation, assuming a dark livid aspect, at the same time that it loses its natural consistence. Serum and pus may also be found in the subserous cellular tissue; while the peritoneal investment is sometimes covered with thick patches of lymph. The veins themselves are always much enlarged, and their cavities are filled with pus, clots of blood, or plugs of plasma. The disease often extends along the venous trunks of the pelvis to those of the abdomen, or even to those of the inferior extremities; and very frequently the absorbent vessels are similarly circumstanced, being greatly augmented in volume, and infiltrated with enormous quantities of purulent matter.

The *causes* of uterine phlebitis are not always very evident. In some cases, it appears to result from violence done in the extraction of the placenta, while in others it may be traced to the effects of cold and moisture, irregularities of diet, or to some peculiar noxious condition of the atmosphere. In general, the disease exhibits all the evidences of erysipelas, or pyemia, both as it respects its pathology and symptoms. Ushered in by rigors, or chills alternating with flushes of heat, it soon assumes a typhoid character, the pulse becoming small and frequent, the tongue dry and parched, and the surface covered with profuse, clammy sweats. The abdomen is exquisitely tender on pressure, the stomach is irritable, the mind wanders, the milk is suppressed, and the lochial discharge is excessively fetid.

The *treatment* must be conducted upon the same principles as in pyemia or erysipelas. Great attention is paid to cleanliness and venti-

lation; free use is made of the chlorides; the syringe is used three or four times a day; leeches and fomentations are applied to the abdomen; the bowels are locked up with opium, to prevent irritation of the peritoneum; rapid, but gentle ptyalism is aimed at; and support is afforded by quinine, carbonate of ammonia, milk punch, and nutritious broths and jellies.

#### HYPERTROPHY.

Hypertrophy of the uterus, as a result of healthy nutrition, is very rare. The affection is usually most conspicuous in association with fibrous tumors, in which it is sometimes truly enormous. Thus, in a specimen in my possession, the walls of the organ are nearly two inches in thickness, and of a firm, dense consistence, grating under the knife. Its cavity is of extraordinary size, and several small tumors are seen projecting from its outer surface. The hypertrophy is sometimes confined to the lips of the uterus, which, especially the anterior, become thick, dense, and stumpy. The immediate cause of hypertrophy of the uterus, in most of the cases that are brought under our observation, is, doubtless, chronic inflammation attended with plastic deposits. The disease often continues for a long time without apparently any disposition either to advance or to recede. The diagnosis is readily ascertained by touch and inspection. If the organ is unusually large, it can be distinctly felt in the hypogastric region, and may cause serious inconvenience by its weight and pressure. The affection must not be confounded with carcinoma.

The *treatment* of uterine hypertrophy must be conducted upon general antiphlogistic principles; by leeches, scarification, and cauterization of the neck and mouth of the organ, and by proper attention to the diet, bowels, and recumbency. The exhibition of mercury will be of no particular avail, except in so far as it may assist in improving the general health; but advantage will be derived from the internal use of iodide of potassium, and of hydrochlorate of ammonia, in doses of from five to ten grains, three times a day.

#### ATROPHY.

Atrophy of the uterus does not offer anything of special surgical interest. The affection may be purely senile, or it may be produced by protracted compression, as by the presence of a fibrous tumor situated in its own substance, an enlarged ovary, or an exostosis of the pelvic bones. When it exists in an unusual degree, it may be a cause of sterility.

Absence of the uterus is uncommon. It is generally associated with deficiency of the ovaries and Fallopian tubes, though cases occur in which the former of these organs are present, and fully developed.

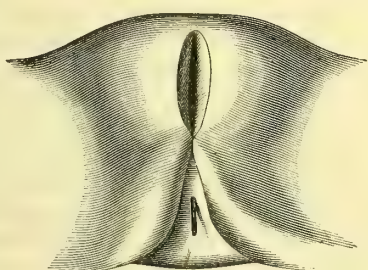
#### STRICTURE AND OCCLUSION.

The mouth of the uterus is sometimes the seat of stricture, being preternaturally small, or so much contracted as scarcely to admit a



silver probe, or even a hog's bristle. This lesion is often congenital, but in other cases it is brought about by inflammatory irritation, in the same manner as stricture of the urethra. A similar condition is sometimes observed in the cavity of the neck of the uterus. The canal, in one of my specimens, represented in the annexed drawing (fig. 543), is completely occluded, for the distance of nearly an inch, by the adhesion of its two walls. A stricture in either of these situations would be a cause of sterility and of painful menstruation, as well as of retention of the menstrual fluid.

Fig. 543.



Stricture of the womb should be treated in the same manner as stricture of the urethra and other mucous outlets; that is, by a series of gradually enlarging metallic and gum-elastic bougies, aided, in obstinate cases, by incision. The case will generally require perseverance, especially if the contraction is very light.

Occlusion of the mouth of the uterus is nearly always the result of inflammation, leading to an effusion of plastic matter gluing together the lips of the organ. The accident commonly occurs soon after delivery, and is sure to be eventually followed by retention of the menstrual fluid, causing the womb to expand in every direction, so as to form a large, globular or ovoidal tumor, extending above the umbilicus, fluctuating distinctly under pressure, smooth on the surface, free from pain, and of a uniform consistence throughout. The general health usually remains for a long time nearly natural, though ultimately it is very apt to suffer. Severe uterine pains, of an expulsive and bearing-down character, are usually experienced at every return of the menstrual period. This circumstance, together with the absence of menstrual fluid, and the peculiar nature of the abdominal tumor, constitutes the most important and reliable diagnostic feature of the complaint.

The *treatment* consists in affording a free outlet to the pent-up fluid, which is generally of a grumous character, or partly fluid, and partly coagulated. Search is made for the natural site of the orifice of the uterus, but if this cannot be found, as near an approach to it is made as possible. The opening may be effected with a broad trocar, or, what is better, with a sharp-pointed bistoury. The contents of the tumor being evacuated, re-closure of the wound is prevented by the protracted use of the tent and bougie. I have by these means succeeded in effecting complete cures in four cases.

#### DYSMENORRHŒA.

Dysmenorrhœa, or painful menstruation, is a very common affection, both in single and in married women, but especially the former. It may depend upon various causes, as a narrow and constricted state of

the uterus, the effects of cold, ovarian disease, and disorder of the general health. In many of the cases that have come under my observation, I have been led to believe that it was of a rheumatic character; a view supported by the presence of the atrocious lumbago which so generally attends it, and the relief afforded by anti-rheumatic remedies. However this may be, the disease is always of an inflammatory character, and is frequently, if not, invariably, attended with a discharge of plastic matter and coagulated blood, the proper menstrual secretion itself being very sparing. The membranous concretion, which is seldom thick or firm, generally moulds itself to the inner surface of the uterus, and is sometimes expelled entire, though much more commonly in small pieces. The period required for the extrusion varies from a few hours to a number of days, and is always attended with much suffering.

The *treatment* of this affection is palliative and radical. The first, which has reference to what should be done during the menstrual attack, consists in the free use of anodynes, as morphia or laudanum, exhibited by the mouth, or, what is preferable, in the form of enema. In either case, from fifteen to twenty grains of camphor may be advantageously conjoined with the hypnotic. If the patient be plethoric, blood is taken from the arm, and the skin is relaxed by aconite or tartar-emetic, and the hot foot-bath. The sacro lumbar region is well rubbed, from time to time, with equal parts of strong ammoniated liniment and laudanum.

Believing that this disease is generally of a rheumatic, or rheumatico-neuralgic nature, I am satisfied that nothing will be found to be so effectual for its radical cure as the steady use of the wine of colchicum, in the dose of one drachm every night at bedtime, with half a grain of morphia, and ten drops of tincture of aconite, persevered in for several successive weeks. If plethora exist, blood may be taken from the arm, and the colchicum may be combined with the antimonial and saline mixture. The diet is properly regulated, the bowels are kept in a soluble state, and exposure to cold is carefully guarded against. Great relief will generally follow the application of a large opium plaster to the lower part of the spine, renewal being effected once a week. If the patient is anemic, the colchicum may, in a short time, be superseded by the use of quinine and iron, in union with strychnine and extract of aconite. When the disease is dependent upon an unusually tight orifice of the uterus, the treatment should be aided by the occasional passage of the bougie; but such an expedient will, I fancy, rarely be necessary.

#### COLLECTIONS OF GAS.

Air now and then collects within the cavity of this viscus, constituting the disease which has been described by pathologists under the name of emphysema, physometra, and tympanites. How this is formed is still a disputed point. In many cases, it can be distinctly traced to the decomposition of effused fluids, as blood, serum, or pus; in others, it is not unlikely that it is the product of a true secretion from the

uterine vessels, brought about by some morbid condition, the precise nature of which is unknown. These accumulations may take place at any period of life, in married females, and are generally an evidence of previous conception. They may also occur in single women, as a result of organic disease. When considerable, they cause the womb to expand and rise up in the abdomen, as in pregnancy, with which it may easily be confounded. After the flatus has existed for several months, the uterus commonly makes an effort to dislodge it, expelling it with a noise somewhat similar to what is occasioned in eructation.

The diagnosis is readily established by the peculiar elasticity and resonance of the tumor, the absence of fluctuation, and the occasional escape of flatus from the vagina.

The *treatment* consists in evacuating the air with the trocar, and in injecting afterwards some stimulating fluid, as a solution of nitrate of silver, iodine, or chlorinate of soda, for the purpose of changing the condition of the mucous membrane of the uterus. If any putrid matter be present, it should, of course, be removed.

#### DROPSY.

Large quantities of water—ten, fifteen, and even twenty quarts—have been known to accumulate in the cavity of the womb, chiefly in young and middle aged married women. The affection, however, is extremely rare, and is always connected with closure of the mouth of the organ, caused by previous inflammation, malignant disease, or some morbid growth. The fluid is generally clear and limpid like the serum of the blood, which it also resembles in its chemical properties. In some cases it is thick and turbid; it has also been found of the color and consistence of coffee-grounds, probably from the admixture of sanguineous matter. The tumor thus formed often simulates pregnancy, is painful on pressure, and slightly fluctuates under the fingers. The disease, which is technically called *hygrometra*, is occasionally connected with utero-gestation, of which it then forms one of the most distressing complications. Its true pathology is still involved in obscurity. In all probability it is dependent upon chronic inflammation of the lining membrane of the womb, the character of which is changed into a sort of adventitious serous structure.

The disease, which is always slow in its progress, is *characterized* by the existence of a tumor, of a rounded shape, which, commencing low down in the pelvis, gradually ascends towards the umbilicus, occupying the middle line. It is soft and fluctuating, dull on percussion, of uniform consistence, and unaffected by position. Its identity with the uterus is easily established by vaginal examination, the neck of the organ being effaced, and the part distinctly fluctuating. When the uterus is not completely occluded, there is occasionally a partial escape of serous fluid. Menstruation is arrested, and the general health, although, perhaps, unaffected in the earlier stages of the disease, always seriously suffers in the end.

The only *remedy* for this complaint is tapping, the operation being performed at the natural site of the orifice of the uterus, or, if this



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The only *remedy* for this complaint is tapping, the operation being performed at the natural site of the orifice of the uterus, or, if this

cannot be found, at the most protuberant portion of the swelling. The fluid being evacuated, patency of the opening is fostered by the retention of the canula, or the use of the bougie. If re-accumulation occurs, the fluid is again evacuated, and an attempt should then be made to destroy the secreting surface of the organ by the injection of a small quantity of a weak solution of tincture of iodine. Tapping above the pubes, in this complaint, is objectionable, as it might be productive of fatal peritonitis.

#### HEMORRHAGE.

Of hemorrhage of the uterus I shall speak only as it affects the organ in the unimpregnated state. The occurrence is most common in married females, about the cessation of the menstrual function, and is observed in every state of constitution, in the strong and plethoric, as well as in the feeble and relaxed. A great variety of causes may give rise to uterine hemorrhage; but by far the most frequent is that peculiar state of the system which accompanies the disappearance of the menses, together with ulceration of the mouth of the womb, or the presence of some adventitious growth. Disease of the ovary also powerfully predisposes to this lesion; and there are some females who are naturally, or from habit, so prone to it that the most trifling exertion is sufficient to bring on an attack. The duration of the hemorrhage varies from a few days to several weeks. When dependent upon structural disease, or the presence of a polypous tumor, the blood often comes away suddenly, in a gush, which continues, at intervals, for a few hours, and then ceases.

Hemorrhage of the uterus, in the unimpregnated state, especially if it be chronic, should always induce a careful exploration of this organ, with a view to the ascertainment of the nature of the exciting cause, which, unless the woman has reached the change of life, will generally be found to depend upon the presence of some tumor, the removal of which promptly arrests the disease.

When the hemorrhage depends upon atony of the uterus, associated with an anemic state of the system, a course of chalybeate tonics, in union with quinine, and the cool shower-bath, is indicated. The bowels should be properly attended to, and the diet should be nourishing, but non-stimulant. The woman should keep her bed or lounge, as the erect posture never fails to aggravate the complaint. If the flow be at all active, acetate of lead and opium, or perchloride of iron, are employed, ice is applied to the hypogastric region, and strict recumbency is observed. If the organ is deficient in proper contractile power, ergot is freely administered. If a good deal of blood has already been lost, prompt recourse is had to the tampon, consisting of a mass of patent lint or raw cotton, a silk handkerchief, or a piece of sponge, wet with a strong solution of alum, and carefully inserted into the vagina, in contact with the orifice of the womb, retention being aided by a large compress upon the vulva and a broad **T** bandage. The most unobjectionable plug of all is the colpeurynter, a gutta-percha bag, inserted into the vagina, and distended with air or water.



If the ordinary materials are employed, substitution must be effected at least every forty-eight hours. In chronic uterine hemorrhage, a large blister to the sacro-lumbar region will often prove beneficial.

#### RETRO-UTERINE HEMATOCELE.

A peculiar form of sanguineous tumor, first accurately described by Mons. Huguier, is occasionally met with in the pelvis, the blood upon which it depends being poured out into the subperitoneal cellular substance of the neck of the uterus, from which it gravitates round the rectum and the upper extremity of the vagina. It usually takes place under the influence of inordinate straining during parturition, excessive sexual excitement, or difficult menstruation, and may acquire such a bulk as to break through its confines into the peritoneal cavity. Generally, however, it is comparatively small, and eventually disappears through the agency of the absorbents. The disease which bears the strongest resemblance to a thrombus of the vulva, is most common in females laboring under a varicose condition of the utero-pelvic veins.

Its *diagnosis* is generally obscure. The most reliable sign is the existence of a tumor at the sides and back of the neck of the womb, distinguishable by the finger in the vagina and rectum, free from pain, and the seat of more or less fluctuation, especially if the examination be made soon after the occurrence of the accident. The fundus of the uterus is generally tilted somewhat forwards towards the pubes, while the neck of the organ is inclined proportionably backwards, and sensibly diminished in length. The affection with which it is most liable to be confounded is dropsy of the ovary, but from this it can usually readily be distinguished by the history of the case, the median position of the tumor, and the suddenness of the attack.

The *treatment* of retro-uterine hematocèle is generally very simple; for, unless the tumor is of unusual bulk, it commonly soon disappears of its own accord, particularly if the woman be kept at rest in the recumbent posture, and upon light diet. If symptoms of inflammation arise, as indicated by pelvic pains and constitutional disturbance, recourse must be had to leeches, fomentations, purgatives, and other antiphlogistics. The sudden disappearance of the tumor, followed by great tenderness in the hypogastrium and depression of the vital powers, should lead to the suspicion of its rupture and the escape of its contents into the peritoneal cavity.

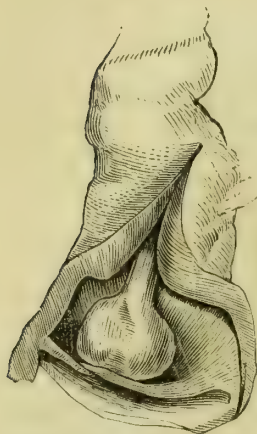
#### POLYPS.

There are, so far at least as my observation extends, not less than four varieties of uterine polyps, the fibrous, vascular, vesicular, and granular, of which the first is by far the most common.

The *fibrous* variety bears a strong resemblance to the fibrous tumor of the uterus, being of a fleshy consistence, firm, yet compressible, smooth, elastic, of a pale grayish color, and composed of dense filaments, which are so intimately interwoven with each other as to render

it impossible to unravel them. In its shape it is commonly globular or pyriform; but now and then it resembles a mushroom, the rounded footstalk being attached to the neck of the uterus, and the base projecting into the vagina, as in the annexed cut (fig. 544), from a specimen in my collection. The fibrous polyp has few vessels and nerves, and is, therefore, little liable to bleed or to be attended with pain. Tumors of this kind have often a very rough surface, and they sometimes contain considerable cavities filled with serum, jelly, pus, or earthy matter.

Fig. 544.



Fibrous polyp of the uterus.

The *vascular* polyp is composed essentially of vessels and cellular tissue, the fibrous element being either entirely wanting, or existing only in a very limited degree. This species is extremely rare, and seldom attains a large size; it is of a red, florid color, of a soft, spongy consistence, sensitive on pressure, erectile, and exceedingly prone to hemorrhage. In respect to shape, it presents the same diversities as the other species.

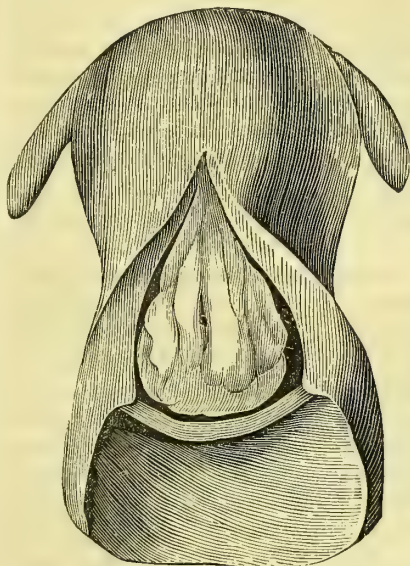
The *vesicular*, cellular, or gelatinoid polyp holds a sort of intermediate rank between the two preceding, being softer than the fibrous and harder than the vascular. It is semi-transparent, of a peculiar grayish complexion, compressible, glistening on the surface, and attached by a delicate pedicle, which renders it pendulous. Carefully examined, it is found to exhibit a shreddy, tremulous structure, interspersed with a few vessels, which are generally too small to emit much blood. The gelatinoid polyp may acquire a large bulk, and is influenced by atmospheric vicissitudes, increasing in size when the weather is moist, and diminishing when it is dry.

The *granular* polyp consists in an enlargement of one or more of the mucous follicles, situated at the mouth of the womb, and described by the older writers under the name of the ovules of Naboth. It almost always occurs in clusters, of a whitish or grayish color, commonly about the size of currants or grapes, suspended by long, slender pedicles, and strongly resembling, in their general appearance, the surface of a cauliflower. When there is only one such tumor, it may attain the volume of a walnut, or of a hen's egg. It is invested by a smooth, delicate, vascular membrane, possesses little sensibility, and often contains a yellowish curdy matter, which is apparently nothing but inspissated mucus. Its connection with the uterus is very slight, and its growth generally very tardy.

Uterine polyps are found of all sizes, from that of a bean up to that of a gourd. Fig. 545 represents a small tumor of this kind, of a pear-like, lobulated form, attached to the base of the cavity of the womb. Their volume, in some cases, is immense, ranging from ten to nearly forty pounds. They occasionally extend far down into the vagina; and cases have been witnessed in which they reached more than ten

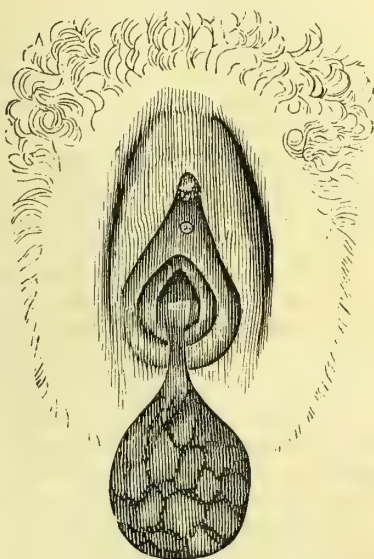
inches below the vulva (fig. 546). The shape of these morbid growths is mostly pear-like; and, although they may originate in any portion of the cavity of the uterus, they are most frequently attached to its

Fig. 545.



Uterine polyp attached to the base of the organ.

Fig. 546.



Uterine polyp hanging from the vulva.

neck. Many of them have a narrow, slender peduncle; and, in such as are of great size, it is not uncommon to see deep fissures, which give them a lobulated arrangement. They are all invested by a thin mucous membrane, which is more or less vascular, and merely a prolongation of that of the womb, immediately beneath which the morbid growth is developed. Large cavities, filled with various substances, are sometimes seen in them.

Polyps of the uterus are most common in elderly women, especially such as have borne children. Their progress, which is usually very tardy, is characterized by vague, irregular pains, and by more or less hemorrhage, with a sense of weight and fulness in the pelvic region, vesical trouble, and a thin, sanious, fetid discharge. The menstrual function is either entirely arrested, or extremely irregular. The diagnosis can only be determined by a careful examination. If the tumor be of considerable bulk, it will be very apt, in time, to protrude at the vulva. Care must be taken not to confound a polyp of the womb with a recto-vaginal hernia, a prolapsed vagina or bladder, or an aborted ovum retained in the neck of the uterus.

The *termination* of this disease is uncertain. In some cases the patient lives in comparative comfort for years, while in others life is rapidly worn out by the constant hemorrhages that are so liable to attend it. I have seen nearly half a dozen women perish from this cause. Now



and then, but very rarely, an instance of spontaneous expulsion occurs, followed by speedy recovery.

The only *treatment* that is of any avail in uterine polyp, is removal, and the earlier this is effected the more likely will the woman be to make a good recovery. The operation may be performed by evulsion, ligation, or excision, precisely as in polyp of the nose. When the tumor is comparatively small, with a narrow pedicle, I always give the preference to the first of these methods, as being both safe, easy, and expeditious. The proper instrument is a large lithotomy forceps, with rough, serrated blades, to insure a firm grasp. Or, instead of this, a Musseux's forceps, or stout vulsellum, may be used. The patient, during the operation, lies on the back, with the limbs elevated and well retracted; and care is taken not to cause undue displacement of the organ.

*Ligation* may be necessary when the tumor does not yield to evulsion, or when it has an unusually large base. The wire may be applied by means of a long double-canula, and should be drawn with great firmness, so as to cause speedy strangulation. Great care is, of course, taken not to include any portion of the uterus.

*Excision*, by itself, is hardly proper in any case, the great objection to it being its liability to cause hemorrhage. The operation may occasionally be advantageously performed after the polyp has been partially or completely strangulated by the ligature, with a view to its more speedy riddance. The most suitable instrument is a long, probe-pointed bistoury, slightly curved towards the extremity, which is carefully insinuated around the neck of the tumor.

Should hemorrhage follow these operations, it may usually be promptly checked by astringents, as powdered alum, or persulphate of iron, and a full anodyne, with ice to the hypogastrium. If these means fail, or the case is urgent, recourse is had to the tampon.

#### FIBROUS TUMORS.

One of the most common appearances in the uterus of elderly females is the existence of fibrous tumors (fig. 547), occurring either in its substance, in its cavity, or on its outer surface beneath the serous coverings. Their shape is usually spherical; their diameter from the size of a hickory-nut to that of a large melon; their weight from a few ounces to upwards of a hundred pounds, as in the remarkable cases reported by Dr. Francis, of New York; their structure firm, dense, opaque, and of a light grayish color, tearing into strong, concentric fibres. Such growths have sometimes a rough, granulated texture, and not unfrequently they contain small cavities, filled with earthy matter, or various kinds of fluids, as serum, jelly, blood, or pus. The calcareous matter, which, in some instances, almost encases these morbid growths, in the form of a thin, brittle shell, not unlike that of an egg, consists chiefly of phosphate and carbonate of lime, together with a minute quantity of animal substance.

Only one such tumor may exist in the uterus; or there may be a considerable number, perhaps as many as six, eight, ten, or a dozen.

When large, they are usually irregularly lobulated, or divided by deep fissures; bloodvessels, often of considerable magnitude, can be traced into their substance. They have no disposition to ulcerate, to become soft, or to assume malignant action; and, although they occur both in the married and the unmarried female, they seldom, if ever, make their appearance before the age of thirty.

When seated under the serous covering of the uterus, these tumors often hang by a very slender neck, and they then assume a pyriform shape. They possess very little sensibility; and, so long as they remain small, they produce no change in the form of the uterus,

or any local inconvenience; but, when they attain a large bulk, they often incommode by their weight, and, by the pressure which they exert upon the bladder and the rectum, may seriously interfere with the expulsion of the urine and feces. When these bodies are embedded in the walls of the womb, or spring from its inner surface, the subjects of them are apt to be barren; or, if they conceive, the uterine tissue is unable to undergo the necessary expansion, and abortion results. Sometimes these tumors are attached to the base of the womb, from which they ascend into the abdomen, where they may be moved about, and thus simulate pregnancy, or enlargement of the ovary.

The *diagnosis* of fibrous growths of the uterus is uncertain, except when they occupy the cavity of the organ, and project down into the vagina, or beyond the vulva, when a careful examination will generally serve to reveal their true character.

When a tumor of this kind has a pediculated attachment, it may sometimes be removed by ligation or evulsion, as an ordinary uterine polyp. When embedded in the wall of the organ, or connected with its outer surface, the case may be regarded as irremediable.

When the growth is situated in the uterine cavity, it is occasionally expelled, and the woman either recovers, or dies of the profuse hemorrhage that ensues.

Fig. 547.



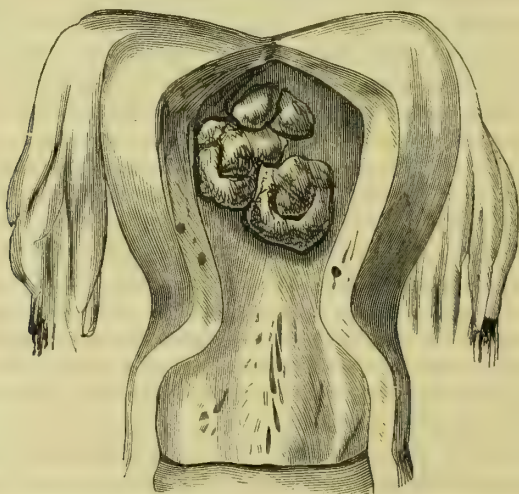
Fibrous tumors of the uterus—both internal and external.  
From a preparation in Professor Meigs' collection.

## CARCINOMA.

Cancer of the womb presents itself in two varieties of form, the scirrhus and the encephaloid, of which the first is by far the more common. Quite a number of diseases, apparently of the most heterogeneous character, but in reality very similar, if not identical, have been described by authors under the several denominations of scirrhus, fungus hematodes, cauliflower excrescences, corroding ulcer, and carcinoma. Scarcely any one of these appellations seems to me to be well chosen, as they have reference rather to certain states or appearances of the parts than to their true nature and constant anatomical characters. Not unfrequently all the conditions expressed by these terms are blended together, and, even when they exist separately, they have invariably the same distinctive tendency.

Malignant disease, be its nature what it may, generally begins at the neck and lips of the organ, from which it gradually ascends to the other parts. So common is this mode of attack that it was once supposed to be invariable in its occurrence. Recent observation, however, has proved that there are numerous exceptions to this rule, the disease in many cases commencing at the base or body of the viscus, and thence spreading downwards towards its inferior extremity. The origin of cancer in the cavity of the organ is well shown in fig. 548, from a specimen in my collection.

Fig. 548.



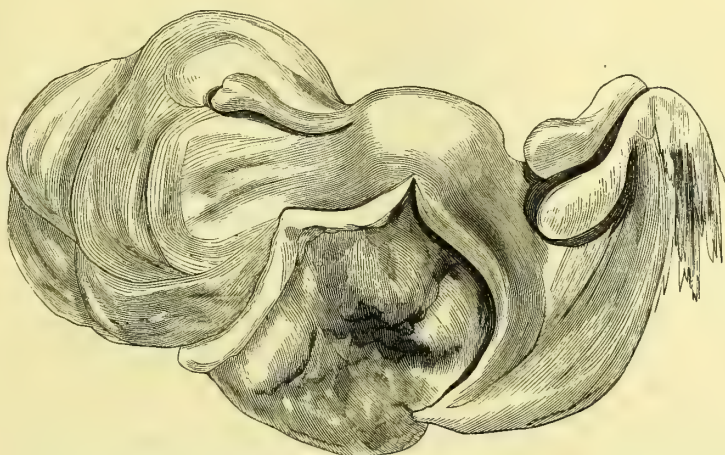
Incipient cancer beginning in the body of the uterus.

In *scirrhus*, the mouth of the womb is usually extremely hard, thick, and irregular, the lips being everted, painful on pressure, and apt to bleed on the slightest touch. After this state has continued for some time, ulceration takes place, a thin, sanious fluid, abundant in quantity, and highly irritating in quality, oozes from the vagina, and all the



textures of the affected part are completely destroyed. The base and body of the uterus, which are often much enlarged, also change their appearance; they become hard and firm, like fibro-cartilage, and are intersected by dense, grayish filaments, running in a radiating direction. The annexed cut (fig. 549), copied from a specimen in the pos-

Fig. 549.



Carcinoma of the uterus beginning at the mouth and neck of the organ.

session of Professor Meigs, affords an excellent illustration of carcinoma of the uterus, beginning at the mouth and neck of the organ, and gradually extending upwards towards its body.

The *encephaloid* variety of the disease generally occurs in the form of soft, lobulated masses, the interior of which contains clots of fibrin, varying in color and consistence according to the length of time they have been deposited. Their size seldom exceeds that of an orange, but sometimes they are as large as a foetal head, of an irregularly globular figure, and of a dark brownish complexion, caused by the secretion of melanotic matter. In other cases, again, though these are rare, the internal structure is of a deep red color, and composed essentially of anastomosing vessels, held together by cerebriform substance.

As carcinoma of the womb, of whatever form, progresses, various morbid growths spring from the ulcerated surface, and fill up the vagina. These, at length, fall off by sloughing, and are either speedily succeeded by others, or they leave a deep, excavated sore, with hard, irregular edges. In this stage of the complaint, there are generally copious discharges from the vagina, consisting of a thin, corroding sanies, serum, pus, or sero-purulent matter, almost insupportably offensive.

Scirrhus of the uterus is most *common* in married females that have borne children, soon after the decline of the menses. Very few cases occur before forty and after sixty. Encephaloid, on the contrary, may take place at any period of life. Of 409 cases of cancer of this organ, examined by Boivin and Dugès, 95 are stated to have broken out

before the thirtieth year, and the probability is that all, or nearly all, of these were examples of brain like carcinoma.

The *symptoms* of cancer of the uterus are usually unmistakable even at an early period of its existence. One of its very first effects is hemorrhage, not slight, but severe, long continued, and recurring, with more or less frequency, throughout its entire progress, becoming gradually more and more profuse, especially in encephaloid. It is, therefore, a phenomenon of great diagnostic value, particularly in the inceptive stage of the affection. The pain is variable. In scirrhus it is usually sharp and lancinating, darting about through the neighboring parts, and coming on at an early period. In soft cancer, it is comparatively slight, especially prior to ulceration, after which it often becomes very severe. The general health seldom suffers much for several months; it then begins to decline, the patient losing her appetite, flesh, and strength, and the countenance ultimately assuming that peculiar, sallow, cadaverous aspect, so characteristic of the carcinomatous cachexia. The discharges are now also very profuse, and generally so excessively fetid as to be almost of themselves denotive of the nature of the malady. If, however, any doubt exist respecting the diagnosis, it will be promptly dispelled by a digital examination. In the earlier stages of the disease, the surgeon will do well to explore the parts both with the finger and the speculum.

As the disease *progresses*, the morbid action gradually extends to the neighboring organs, as the vagina, rectum and bladder, the two latter of which are frequently laid open, thus adding greatly to the suffering of the poor patient. The body of the uterus usually retains its integrity longer than any other portion of the organ. After death, the pelvic viscera are generally found more or less matted together, and the lymphatic ganglions in a state of enlargement.

The period at which carcinoma of the uterus proves fatal varies in different cases and under different circumstances. Of 120 cases, reported by Dr. J. C. W. Lever, of London, 107 died at an average period of twenty months and a quarter from the invasion of the malady. The shortest duration was three months; the longest, five years and a half. Marriage and the previous state of the health did not appear to have exercised any particular influence upon the progress of the disease.

The *treatment* of cancer of the womb can only be palliative. Excision, it is true, has occasionally been advised, and even some very *daring* feats of this kind have been performed, always, however, eventuating fatally, either on the spot from shock or hemorrhage, or, at farthest, in a few months from a recurrence of the disease, or, what is more probable, from a want of thorough removal. The whole sum of the treatment with the honest and conscientious practitioner resolves itself into the adoption of measures calculated to assuage pain, arrest hemorrhage, promote cleanliness, and support strength. Recumbency will generally greatly contribute to comfort. When the morbid mass presents itself in the form of numerous excrescences, portions of it may often be advantageously destroyed with the actual cautery, introduced through a wooden speculum.

## HYSTEROTOMY, OR CÆSAREAN SECTION.

Various circumstances may arise to render it necessary to open the womb and extract the child, among which the more important are, deformity of the pelvis, rupture of the uterus and the escape of the child into the abdomen, and the sudden death of the mother from accident or disease. The mortality of the Cæsarean section has been variously estimated; thus, some have placed it at 63 per cent., while others have asserted that about two-thirds of those upon whom it is performed perish. Of 424 cases analyzed by a foreign writer, 210, or nearly one half, died. Velpeau states that no successful example occurred in Paris during a period of forty years, and in Great Britain the result has been nearly equally unfortunate. Professor Gibson has succeeded twice in saving both mother and child, in the same patient. Dr. William Byrd Page and Dr. John Neill, of this city, have each had a case in which they succeeded in saving the mother, but not the child, the cause demanding the operation being rupture of the uterus. In the *North American Medico-Chirurgical Review* for July, 1859, Dr. W. F. McClelland, of Council Bluff, Iowa, has detailed the particulars of a case in which both lives were saved.

When hysterotomy is necessary, no time must be lost in performing it; indecision and delay would inevitably be fatal. The bladder having been emptied, and the woman lying on her back with the uterus well supported on each side, an incision is carried through the integuments along the linea alba, commencing just above the pubes, and terminating near the umbilicus. The tendinous structure is then cautiously divided down to the peritoneum, which is next severed to the requisite extent with a probe-pointed bistoury. The wall of the uterus being now carefully incised, the exposed membranes are ruptured, either through the vagina, or otherwise, and the child and placenta extracted. Clearance of the pelvic cavity being effected, and any bleeding vessels secured, the abdominal wound is approximated by the twisted suture and adhesive plaster, and the case treated upon ordinary antiphlogistic principles, large doses of opium being given to control the bowels and prevent peritonitis, and special attention being paid to the temperature of the patient's apartment.

## SECT. II.—AFFECTIONS OF THE OVARY.

The most important diseases of the ovary, surgically considered, are inflammation and various kinds of tumors, both of an innocent and a malignant character.

## INFLAMMATION.

Inflammation of this organ, technically called *ovaritis*, is probably a much more common disease than is generally imagined. It is most liable to occur after difficult parturition, provoked abortion, and suppression of the catamenia, in consequence of cold. In lying-in females



it is generally complicated with inflammation of the uterus, Fallopian tubes, and pelvic veins, and, in all cases, it is extremely prone to extend to the peritoneum.

The *symptoms* of ovaritis are usually extremely obscure, a circumstance which readily accounts for the fact that the disease is so often overlooked. In general, the existence of the lesion may be inferred when there is excessive pain in the pelvic cavity, deep-seated, circumscribed, of a burning nature, and aggravated by pressure, motion, and the erect posture. As the inflammation spreads, the pain and tenderness become more diffused, and the patient generally lies with the limbs well retracted, to take off the tension from the abdominal muscles. High fever is always present; and, if the finger be introduced into the rectum, the ovary may often readily be detected by its large and globular feel.

When the disease passes into *suppuration*, the occurrence is denoted by rigors, alternating with flushes of heat, and accompanied by throbbing pains and an increased sense of weight in the pelvic cavity. If the quantity of pus be considerable, its existence may generally be discovered by a digital exploration of the lower bowel. The abscess may burst into the peritoneal cavity, causing fatal inflammation; or it may send its contents into the rectum, vagina, or bladder. Occasionally, again, especially when the inflammation is associated with disease of the uterus and Fallopian tubes, the abscess points in the groin, or in the ileo-inguinal region.

Large accumulations of pus, or sero-purulent fluid, occasionally form in chronic disease of the ovary. In a case of this kind, reported by Dr. Taylor, of this city, the quantity amounted to four gallons. The disease was of long standing, and the organ was converted into a large, vascular sac, weighing seventeen pounds after the removal of its contents.

Ovaritis must almost necessarily be a dangerous disease, especially when it passes into suppuration, owing to its masked character, and its consequent liability to be overlooked at a time when *treatment* alone can be of much service in arresting its progress. The principal remedies, in the earlier stages of the disorder, are, venesection, especially if there be marked plethora; leeches to the hypogastrium and perineum, followed by fomentations; light diet; strict recumbency; and the use of aconite and morphia, with the neutral mixture. If there be much tenderness of the abdomen, a large blister should be applied. The lower bowel is maintained in an empty condition by enemata, but purgatives by the mouth should be proscribed, as calculated to aggravate the disease. In ovaritis, consequent upon the puerperal state, the vagina should be frequently washed out with demulcent injections, medicated with liquid chlorinate of soda.

If matter be detected, it may be evacuated through the posterior wall of the vagina, by means of a long, curved trocar, the canula of which may be retained for a few days, to insure patency of the puncture. If pointing occur in the groin or iliac region, the opening is, of course, made there, but great care is taken not to do this until there is reason to believe that the sac of the abscess has formed firm adhesions

to the surrounding structures. In chronic abscess, the matter sometimes escapes spontaneously by the vagina, or through an aperture in the wall of the abdomen. Should artificial evacuation be demanded, it may easily be effected by a puncture through the linea alba.

## TUMORS.

The principal innocent growths of this organ are the fibrous, cartilaginous, and encysted, the latter of which may be either single or multilocular. Of the malignant, by far the most common is the encephaloid; the colloid, melanotic, and scirrhus being very infrequent.

The purely *fibrous tumor* of the ovary is uncommon; in most cases it occurs in association with more or less cartilaginous matter and osseous concretions. Its density is, consequently, very great, so much so, as to bear a close resemblance to a mass of scirrhus, thus sometimes deceiving the unwary in regard to its real character. Occasionally considerable sized cysts, filled with various kinds of materials, are interspersed through its substance. In cases of long standing, the fibrous tissue is sometimes almost entirely replaced by the cartilaginous and osseous. The tumor is of a whitish, grayish, or drab color, irregularly lobulated, of slow growth, free from pain, or nearly so, and capable of attaining a large bulk, often weighing many pounds, and greatly incommodating by its pressure.

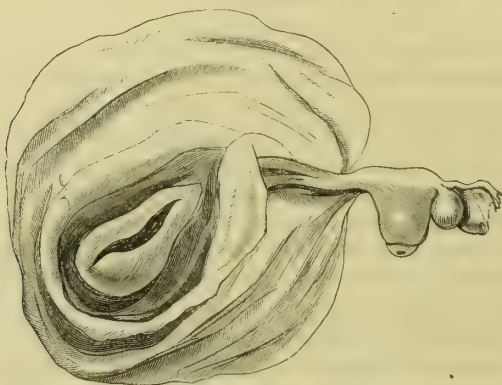
The *unilocular cyst*, or the simple encysted tumor of the ovary, is, as the name implies, a single bag, consisting essentially of the peritoneal and albugineous tunics of the organ, greatly thickened by interstitial deposits, and occupied by serous fluid, of a pale straw color, viscid in its consistence, and composed of a large portion of albumen, as is shown by the fact that it is nearly all converted into a solid mass on the application of heat. Its quantity varies in different cases, and under different circumstances, from a few ounces to a number of gallons, as many as thirteen having been removed at a single operation. When the disease is of long standing, the fluid is often remarkably changed in its physical properties. Thus, it may be thick and ropy, like soft soap; green and tremulous, like jelly; or dark and thick, like molasses. The cyst is, at first, very thin, and perhaps, almost translucent; but as the disease progresses, it steadily augments in thickness and strength, and eventually acquires almost a leathery firmness. Under these circumstances, also, it generally forms adhesions to the surrounding parts, especially the walls of the abdomen, the bladder, uterus, omentum, and small intestine. Vessels, of considerable size, may be seen passing over its surface and dipping into its substance.

Of the *causes* of ovarian dropsy, properly so called, we are entirely ignorant; it is often, it is true, ascribed to external injury, as a blow or kick upon the abdomen, or violence sustained during parturition, but whether it is really ever produced in this way admits of doubt.

Hardly any *period* of life, after puberty, is perhaps entirely exempt from this disease, but experience has shown that it is most common between the twenty-fifth and fortieth years, or the period of the greatest activity of the sexual organs.

The annexed cut (fig. 550) represents a unilocular ovarian cyst of large size, from a preparation in my cabinet. The uterus is seen to retain its natural form and volume. Attached to its left horn, at the

Fig. 550.



Ovarian cyst.

origin of the Fallopian tube, is a small, globular cyst, adherent by a short, slender pedicle, and entirely unconnected with the ovary on that side.

The *multilocular tumor*, or compound cystic growth, of the ovary, is composed of a congeries of cavities closely connected together, or developed, as it were, within each other, of variable size and shape; some being small, and others large, some round, and others ovoidal, or more or less irregular, and most of them occupied by different substances. The youngest generally contain a thin, serous fluid, whereas those that are of long standing are filled with a thick, glutinous material, resembling jelly, soft soap, suet, honey, molasses, or a mixture of blood and starch. The larger cysts are often capable of containing several pints, and when this is the case, their walls are frequently from three to six lines in thickness, very strong, and remarkably vascular. The multilocular tumor is usually of rapid development, and is capable of acquiring an enormous bulk, becoming early united to the surrounding parts, and seriously implicating the general health. Cases, however, occur in which its progress, at least for a time, is quite slow. Thus, in a middle aged woman who was under my charge last summer, the disease was of nearly twenty years' duration.

The two forms of cysts here briefly described are sometimes associated; one part of the tumor being unilocular, the other multilocular. Again, instances occur in which they contain, as already intimated, various kinds of solid matter, as fibro-cartilage, cartilage, and bone. Sometimes they are occupied by hydatids, or acephalocysts, either attached to the inner surface of the sac by narrow, slender necks, or floating about in serum. There is occasionally an ovarian tumor, which contains teeth, hairs, and foetal bones, either in separate cysts, or enveloped in a peculiar saponaceous, fatty, or suety substance. These products now and then occur as a consequence of generation by inclusion; but generally they are the result of extra-uterine concep-



tion. Finally, cystic ovarian growths, whether simple or compound, are liable to take on inflammation, eventuating occasionally in suppuration, or in the formation of abscesses.

*Malignant growths* of the ovary are very rare. The most common is the encephaloid; the scirrhus, colloid, and melanotic being, as already stated, extremely infrequent.

*Encephaloid* may occur at any period of life, in girls as well as in married women, and usually runs its course with frightful rapidity. The brain-like matter, which distinguishes this disease, is generally found in small, irregular masses, inclosed in distinct cysts, of a fibrous texture. These masses sometimes attain a very great magnitude. They are usually of different shades of color, being of a pale olive, brownish, or mahogany in some places, white, cream-like, or grayish in others. Branches of vessels may often be traced, in great numbers, into their structure; and not unfrequently they contain large cysts, filled with serum, pus, or sanious fluid.

*Scirrhus* may occur by itself, constituting a hard, dense mass as large as a fist or even a child's head, of an irregular globular shape, of a whitish, grayish, or drab colored aspect, and intersected by a great number of membranous filaments. The disease is most liable to show itself about the decline of the menses, and occasionally co-exists with other morbid growths.

*Colloid* of the ovary may occur alone, or it may co-exist with other morbid products, particularly the fibrous and encephaloid; it is capable of attaining a large bulk, and exhibits the same structure as in other parts of the body.

Melanosis of this organ is not only extremely rare, but probably never occurs without similar disease in other organs.

*Diagnosis.*—Tumors of the ovary, from whatever cause arising, are liable to be confounded with various other affections, of which the principal are ascites, tumors of the uterus, pregnancy, and enlargement of the omentum, liver, spleen, and kidney. The greatest difficulty usually occurs when the morbid growth is of a solid nature.

From *ascites* cystic tumors of the ovary are usually distinguishable by the following signs: 1. They are more tense, circumscribed, and protuberant. 2. They are situated more to one side, especially in the earlier stages of their progress, whereas in general dropsy the distention is equally diffused. 3. They are but little, if any, influenced by change of posture, while in ascites the fluid gravitates towards the lowest part of the abdomen when the patient sits up, and towards the posterior part when she lies down. 4. In ovarian dropsy the neck of the uterus is usually drawn up into the pelvis, perhaps almost beyond the reach of the finger; in peritoneal effusions, on the contrary, it occupies its accustomed situation. Finally, important information is usually furnished by the state of the general health in the two affections. In ovarian dropsy, especially the unilocular variety, the health nearly always remains natural, or nearly so, for a long time; whereas in ascites it is commonly more or less seriously disturbed from the first, the disease which causes and accompanies it having seriously impressed itself upon the constitution before the effusion shows itself.

To these circumstances it may be added that ovarian dropsy is usually very tardy in its progress, while ascites is ordinarily quite the reverse. When the disease is complicated with abdominal dropsy, the diagnosis may usually be promptly established by paracentesis.

Tumors of the *uterus* may be mistaken for ovarian, and conversely, as is proved by the fact that quite a number of operations have been undertaken for morbid growths that were supposed to be ovarian, but which turned out to be uterine. The diagnosis between the diseases of these two organs is by no means always easy. The enlargement of the uterus may depend upon a solid tumor in its cavity, its walls, or upon its outer surface, and the consequence may be that the organ is pushed to one side, thereby closely imitating the situation of an ovarian tumor, especially in its earlier stages, and rendering it quite impossible to discriminate between them. As the disease of the uterus advances, however, the effacement of the neck of this organ generally affords unmistakable evidence of the fact that the disease is not ovarian. A fluctuating tumor of the uterus is sometimes formed by the retention of the menstrual fluid; but its median situation, its globular figure, the absence of the catamenia, and the obliteration of the mouth of the organ, will afford a sufficient guarantee against any errors of diagnosis. Similar changes occur in dropsy of the uterus; while in physometra, or gaseous accumulations, the remarkable resonance accompanying the disease will always be characteristic.

*Pregnancy* has been mistaken for ovarian disease; such an accident, however, can hardly happen in the hands of a cautious and educated surgeon. The chief signs of distinction are, the history of the case, as the morning sickness and the absence of menstruation; the median situation and gradual development of the tumor; the changes in the mouth and neck of the uterus; and, by and by, the discovery of the pulsations of the foetal heart and of the placenta.

A sarcomatous enlargement of the *omentum* has been mistaken for an ovarian tumor. The patient, about to be operated upon, has suddenly died, and the dissection has revealed remarkable disease of the omentum, but none whatever of the ovary.

An enlarged *liver*, spleen, or kidney, or morbid formations connected with these organs, have occasionally led to errors of diagnosis, and several instances have been reported where, under such circumstances, the abdomen was laid open under the conviction that the morbid growth was a diseased ovary. The elevated and lateral situation of the enlargement, or tumor; its gradual development from above downwards, instead of from below upwards, as in ovarian disease; the continuance of the menstrual function; and the natural position of the neck of the uterus, will generally suffice to prevent mistake. The history of the case will also serve to throw important light upon the diagnosis; for in organic diseases of the liver, spleen, and kidney there are always symptoms peculiar to the affections of each of these organs, and which, consequently, are wanting in ovarian tumors.

Finally, inordinate distention of the abdomen from the accumulation of *fecal matter* has occasionally been mistaken for ovarian enlargement.

Any doubt, however, arising from such an occurrence, may readily be dispelled by an efficient cathartic.

The diagnosis between *ovarian growths* themselves is not always so easy as might at first sight appear. The multilocular cyst is usually distinguishable from the unilocular by the greater rapidity of its growth; its more solid character, one part feeling hard and another soft; by a sense of greater weight and pressure; by the more early failure of the general health; and by the more marked enlargement of the subcutaneous veins of the abdomen.

The fibrous, cartilaginous, and other solid non-malignant tumors may generally be readily distinguished, at least in their early career, by their lateral situation, their great firmness and mobility, by the tardiness of their progress, and by the want of disturbance of the general health, which frequently remains unaffected for years. Malignant ovarian tumors, on the other hand, are characterized by the rapidity of their progress, by their great bulk, by the severity of the local suffering, and by the inroads which they always make upon the constitution even at a very early period of their existence. In encephaloid growths the surface of the abdomen is generally knobby, or very irregular, being hard and firm at one point, doughy and semi-solid at another, and, perhaps, elastic and fluctuating at a third. The disease, in its latter stages, is always accompanied by great enlargement of the subcutaneous veins.

The presence of *adhesions* between the tumor and the surrounding parts may generally be inferred by the want of mobility of the morbid mass, as determined by the variation of the patient's posture, a careful digital examination, and the effects of a full inspiration, during which, if the tumor be non-adherent, it is sensibly depressed by the descent of the diaphragm.

*Progress.*—The progress of ovarian tumors is extremely variable. In the benign forms, it is often remarkably slow, causing hardly any suffering, either local or constitutional. Hence, the patient often lives in comparative comfort for years together, and may even bear children, though, in general, abortion takes place if pregnancy occurs, owing to the inability which the uterus experiences in expanding so as to accommodate itself to the gradual growth of the child. In most cases, however, she suffers great inconvenience and annoyance, and ultimately dies exhausted, either from the drain upon her system, or from constitutional irritation. The multilocular tumor is always a more serious disease than the unilocular, or fibrous; while the encephaloid pursues a most rapid and unrelenting course, death usually occurring within from ten to fifteen months from the invasion of the malady.

In the simple encysted tumor, the sac is sometimes ruptured, either spontaneously, or accidentally; occasionally followed by a radical cure, especially when the tumor is small, but very frequently also by death. Thus, of 72 cases of this kind collected by Mr. Tilt, 32, or nearly one-half, perished from peritonitis.

*Treatment.*—Medical treatment exerts but little, if any, direct influence upon the progress and termination of ovarian disease of any kind. A cure, it is true, has occasionally been effected in unilocular



dropsy of this organ, but the occurrence is so extremely infrequent that it can only be regarded as an exception to a law whose general operation is opposed to such a result.

The remedies upon which the greatest reliance has hitherto been placed are the different preparations of iodine, as Lugol's solution and iodide of potassium, given in moderate doses, three times daily, and the ointment of iodide of lead, and the dilute tincture of iodine, applied freely to the tumid abdomen, at least twice in the twenty-four hours. Pressure has also been highly recommended, but, although I have frequently tried it, I do not know that it has ever afforded any good in my own hands, and the same remark, in fact, is true of everything else that I have ever used in the way of general and local medication. Mercury, carried to gentle and persistent pyalism, has been employed in numerous instances without any benefit.

The treatment, as far as surgical interference goes, may be divided into palliative and radical; the former consisting of occasional tapping, to take off the weight and pressure of the fluid from the diaphragm and abdominal viscera; and the latter in the removal of the tumor, or, if it be encysted, in the injection of certain fluids, or the excision of a portion of its walls, with a view to the obliteration of its cavity.

*Tapping* of the unilocular form of ovarian dropsy is frequently required with a view to palliation; but it should not, as a general rule, be performed so long as the patient is comparatively comfortable, experience having shown that when it has once been done it will usually have to be done soon again. I am acquainted with a case, in which the cyst, however, is combined with a solid tumor, where the operation has been performed upwards of sixty times in less than a year, the quantity of fluid removed at each operation being from four to eight quarts. The patient will usually be likely to get on well after tapping when the cyst is perfectly simple, or when it is associated with a stationary fibrous tumor of small size. In a case upon which I operated for Professor Meigs, in 1856, paracentesis had been performed twenty-seven years previously, the general health being all along excellent. Twelve months ago, the patient sent for me to tap her again, but, at my solicitation, she has borne with her burden up to the present moment, the only inconvenience which she experiences being from the large size of the abdomen interfering with exercise and good looks. In general, the water rapidly re-accumulates after tapping, despite all that can be done to prevent it. In most of the cases in which I have performed it, the tumor was as large in three or four weeks, and sometimes even at the end of a fortnight, as at the time of the operation. In consequence of the steady drain thus established, the patient generally rapidly declines in flesh and strength, and ere long dies completely exhausted. Now and then, however, an extraordinary exception occurs. Thus, in the celebrated case of Martineau, paracentesis was performed eighty times in twenty-five years, the entire quantity of water removed being, in round numbers, eight hundred and twenty-nine gallons. The largest amount of fluid evacuated at any one operation was fifty-four quarts.

Temporary relief occasionally follows tapping in the multilocular

variety of ovarian dropsy, even when the quantity of water that escapes is comparatively small.

The best point for performing the operation is the site of the ordinary operation in ascites; the patient is placed in a similar posture, with the same precaution as to the support of the abdomen, and the most suitable instrument is the ordinary large, round trocar. When the tumor occupies the side of the abdomen, care must be taken to puncture it external to the course of the epigastric artery, otherwise this vessel might be wounded, and the patient die of hemorrhage. The operation may sometimes be advantageously performed at the umbilicus, which, when the tumor is large and of long standing, often presents a pouting appearance, in consequence of the separation of the straight muscles. In a case which was under my observation not long ago, the patient, a highly respectable lady, was in the habit of tapping herself here with an ordinary thumb lancet whenever she suffered more than usual oppression. Sometimes, again, the puncture may be made through the posterior wall of the vagina, which, as stated elsewhere, is often sensibly protruded before the accumulated fluid.

When tapping is performed in the multilocular variety of dropsy, the puncture should be made in the most prominent and fluctuating part of the tumor. If one cyst does not yield the requisite supply, another is opened, an eye being always had to the situation of the epigastric artery.

When the operation is over, the abdomen should be firmly compressed by means of a thickly-folded cloth and a broad bandage, in the hope of preventing early reaccumulation. The effect should be steadily maintained for several weeks, and should be aided by attention to the diet, bowels, and urinary secretion.

Simple tapping is by no means always a safe operation. Of 117 cases reported by Kiwisch, Lee, and Velpeau, 16 perished during the first twenty-four hours; nearly as many within the first month; and a still greater number during the first year. I have myself never met with this accident, except in one instance, although I have performed the operation quite a number of times. But even in that case, death was attributable, not to the operation, but to the imprudence and obstinacy of the patient; for, in spite of all my remonstrance, she went home, a distance of upwards of one hundred miles, on the third day after she was tapped, where she died a short time after from peritonitis.

Tapping has occasionally been combined with the permanent retention of the canula, in the hope that it might excite inflammation in the sac, and thus cause obliteration. Le Dran, who, in 1736, was the first to employ this procedure, has published two interesting cases of cure by it; and in modern times it has also occasionally succeeded, although in quite a number of instances it has proved fatal, either from peritonitis or constitutional irritation. Recamier and Kiwisch proposed to perform the operation through the posterior wall of the vagina.

A cure has sometimes followed *excision* of a portion of the sac, drawn out through a small wound in the linea alba; the rest of the sac being either secured to the edges of the external opening, or permitted to

sink into the pelvis. The procedure, however, is one of much hazard, as it is generally succeeded by violent inflammation and death. Nearly one-half of the cases that have been thus treated have perished, so that the operation is, perhaps, more fatal than ovariectomy itself.

Attempts at a radical cure by *injections* have occasionally been made. Some years ago, the operation was quite the fashion, and was only arrested by its want of success, or, rather, by its mortality, which was, on the whole, proportionably very large. Even in many of the cases that were reported as successful, the dropsy eventually returned, and soon attained its former height. The favorite article for injecting the sac was the tincture of iodine, sometimes pure, but more generally considerably diluted, and introduced in quantities varying from one to six or eight ounces, according to the size and age of the cyst. As might have been supposed, the operation was often followed by severe inflammation, leading to copious sero-sanguinolent effusion, and not unfrequently extending to the peritoneum. It must be evident that such a procedure is chiefly applicable to small and recent ovarian cysts, but even here I should hesitate a good while before resorting to it.

*Extirpation* of the unilocular ovarian cyst has often been attempted; sometimes successfully, at other times with a fatal result, the precise ratio of mortality not having been determined by any reliable statistics. Such an operation, it appears to me, is only justifiable, as a general rule, in the event of rapid re-accumulation after tapping, attended with gradually increasing prostration, rendering it certain that the case, unless speedily relieved, must inevitably end fatally. Under such circumstances, no conscientious surgeon should hesitate to interfere; if the result is unfortunate, life is destroyed only a little sooner than it otherwise would be; if successful, the surgeon achieves a real triumph. In the more ordinary cases, the patient can be made comfortable by occasional tapping and attention to the general health.

When tapping is of no avail, and the case is steadily progressing from bad to worse, the tumor not only seriously interfering with respiration but actually imperilling life, the only resource is extirpation; an operation whose merits, however, are far from being fully settled, notwithstanding the numerous instances in which it has been employed. That the operation has been wantonly performed, in the hope of acquiring temporary élat, is unquestionable, and that much sacrifice of life has been the consequence is equally true. But this is an abuse of ovariectomy, not a right use of it, which it shares in common with every one of the great operations in surgery. Ignorance, stupidity, covetousness, and selfishness, are peculiar to no pursuit. My opinion has always been, that extirpation of the ovary is, under certain circumstances, not only justifiable, but imperatively necessary; and, I must confess, I have no sympathy with those who condemn this operation, and yet, almost in the same breath, remove an ulcerated cancerous breast, or a jaw bone affected with encephaloid, in the hope, as is alleged, of enabling the poor patient to eke out a few short months of a miserable existence. Consistency is a virtue in surgery as it is in everything else.

The great difficulty in regard to ovariectomy consists, not in its performance, but in knowing when it is absolutely indicated. That there



are cases of disease which do not admit of the use of the knife, all educated, honest, and reflecting surgeons are agreed. One of the great obstacles to success grows out of the difficulty, if not utter impossibility, in many cases, in arriving at a correct diagnosis, no matter what pains may be taken in the investigation. Hence, it is not surprising that in at least three-tenths of the cases that have been subjected to the knife, the operation had to be abandoned, while, in quite a number of others, no ovarian tumor of any kind was found. No man should be so foolhardy as to operate in the dark, or at a venture, in the hope that the issue may be a successful one, when he has no positive assurance as to the character of the disease for the relief of which he is about to assail a human being. The following are the circumstances which, it seems to me, would render ovariectomy proper:—

1st. Simple cysts, attended with rapid re-accumulation after repeated tapping, and a regular, steady downward tendency, rendering it probable that, if relief be not soon afforded, the disease will prove fatal.

2d. Multilocular cysts, steadily progressive, but without strong adhesions, and accompanied by gradual decline of health and strength.

3d. Solid tumors, of a non-malignant nature, whether fibrous, cartilaginous, or osseous; especially when they are rapidly increasing in size, or have already attained a large bulk, and are attended with ascites and more or less disorder of the general health; provided, of course, that there are no serious adhesions. In this category I would include those tumors of the ovary which are caused by extra-uterine foetation and by conception by inclusion, particularly when there is reason to believe that the patient will perish unless assisted in this way.

On the other hand, I should consider an operation as unjustifiable, 1st, when the tumor, whatever may be its structure, is strongly and extensively adherent; 2dly, when the disease, in consequence of neglect, mismanagement, or other causes, has been productive of such a degree of exhaustion as to render it probable that the patient will not be able to bear the shock of the operation; 3dly, when the tumor is unequivocally of a malignant nature; and, 4thly, when it is impossible to arrive at a satisfactory diagnosis, especially after having made an exploratory incision.

The operation of *ovariectomy* is of American origin, having been first performed in December, 1809, by Dr. Ephraim McDowell, of Kentucky. The patient, a married woman, the mother of several children, recovered without an untoward symptom, surviving the operation thirty-two years. The tumor was partly solid, and partly fluid, its weight being twenty-two pounds and a half. Until recently it was generally imagined that this operation had been devised and first practised by L'Aumonier, of Rouen, in 1776; but in my Report on Kentucky Surgery, presented to the Kentucky State Medical Society in 1852, I clearly showed that the case of the French surgeon was one simply of abscess of the ovary and Fallopian tube, occurring in a prostitute consequent upon parturition. For the purpose of affording free vent to the purulent fluid, which had for some time es-

caped by the vagina, an incision, four inches in length, was made along the lower edge of the external oblique muscle, when, the diseased parts being separated from each other, the ovary was removed. The organ, which was encysted, was about the volume of an egg, and of great hardness.

It is believed that Dr. McDowell performed the operation of ovariectomy altogether about thirteen times. His first three cases were published in the seventh, and the last two in the ninth, volume of the Philadelphia Eclectic Repertory. Of these cases, three recovered, one perished of peritonitis, and the other remained well for nearly five years, when the tumor, which had been tapped, but which it was found impossible to extirpate on account of its firm adhesions, recommenced growing, and gradually regained its former bulk. In three other cases, of which I have been so fortunate as to collect the particulars, the operation, in one, was perfectly successful, while in the other two it had to be abandoned on account of the impossibility of detaching the morbid growth.

The operation, as now practised, is performed at the middle line of the abdomen, either by the long, or short incision, as it is termed, the choice depending upon the nature of the case, especially the size of the tumor, and the presence or absence of adhesions. McDowell, in his first case, made his incision on the left side, some distance from the outer edge of the straight muscle, its length being nine inches. Subsequently, he cut through the linea alba, and this is the place now universally selected for the operation, the patient lying upon her back on a table, with the head and shoulders well elevated, and the feet resting on a high chair. The bowels and bladder are thoroughly emptied as a preliminary step, and the health put in as good a condition as the exigencies of the case will admit of. The superficial incision, commencing just above the pubes, is made with an ordinary scalpel, and extends through the skin and cellular tissue. The linea alba is then pierced, when, a probe-pointed bistoury being inserted, the wound is enlarged to any extent that may be deemed necessary. In some instances it has been carried as high up as the xiphoid cartilage of the sternum. No vessels are divided in this stage of the operation. The tumor, if perfectly loose, is now separated at its pedicle, previously surrounded with a stout, well waxed ligature, drawn very tightly, and secured with three knots, one end being cut off close, while the other is brought out at the inferior angle of the wound. If the pedicle is very large, it will be well to pierce it with a needle armed with a double ligature, one of which is then tied on each side. Too much care cannot be taken, in this respect, otherwise, the thread slipping off prematurely, the patient may perish from hemorrhage. Occasionally it becomes necessary to embrace the Fallopian tube in the ligature, owing to its intimate connection with the ovary. Within the last eighteen months the separation of the pedicle has occasionally been effected with the *écraseur*, the first operation of the kind having, I believe, been performed by Dr. W. L. Atlee, of this city. It does not always, however, afford complete immunity against hemorrhage; and for this reason the ligature should generally have the preference.

When the tumor is found to be attached, the adhesions should be separated with the fingers, the knife being used only when they are so strong as to refuse to yield in this way. But the instrument must be employed warily; chiefly, indeed, for the division of narrow, slender, bands, for if the adhesions are unusually firm and extensive, such a procedure would inevitably be followed by copious hemorrhage, and violent, if not destructive, peritonitis.

The operation, in the event of the tumor being unusually large, may generally be greatly facilitated by letting out some of its contents, as may always easily be done when they are of a fluid character. The bowels, during the operation, should be carefully protected by an assistant.

The extirpation being completed, the bleeding arrested, and any fluid that may have fallen into the pelvic cavity removed with the sponge, the ligature attached to the pedicle is brought out at the lower angle of the wound, the edges of which are next to be approximated by numerous points of the twisted suture, the pins being carried close down to the peritoneum, in order that, if recovery should take place, the woman may not afterwards be the subject of hernia. Long adhesive strips should be stretched across the intervals of the pins, nearly round the abdomen, which should be still further supported with a compress and a bandage. To avoid irritation, Mr. Handyside, in 1846, carried the ligature through the recto-vaginal cul-de-sac into the vagina, and a similar procedure has since occasionally been pursued by other surgeons.

The woman is now carried to bed, with her head and limbs elevated, to prevent tension of the abdomen, and a full dose of morphia, by which I mean at least one grain and a half, is given, for the triple purpose of allaying pain, inducing sleep, and insuring tranquillity of the bowels, which should not be disturbed for days together, except by an enema, in the event of unusual flatulence and colicky suffering. The anodyne is from time to time repeated; the diet should be of the blandest character; thirst should be allayed by ice, held in the mouth until it is dissolved, but no water should be used, lest it should cause vomiting; and the temperature of the apartment should be regulated by the thermometer, being uniformly kept at about 78° of Fahrenheit. Above all, care is taken that the patient is not exposed to any draughts. As the great danger after this operation is peritonitis, everything should be done to ward off the attack, an ounce of prevention here being worth many pounds of cure. The pins should not be removed until there is firm union in the wound, and the parts should be well supported for a long time afterwards. The ligature is detached at a period varying from one to several months.

When both ovaries are diseased, they should be removed in immediate succession; an operation first performed by Dr. John L. Atlee, of Lancaster, Pennsylvania, his case, which terminated successfully, having occurred in June, 1843. More recently, the operation has been performed by Dr. Peaslee, of New York, and by several other surgeons.

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this subject are those of Dr. George H. Lyman, of Boston, published in 1856, in a paper to which was awarded the Prize of the Massachusetts Medical Society. It is founded upon an analysis of 300 cases of ovariectomy, performed indiscriminately for various kinds of diseases, including the one by L'Aumonier, undertaken for the relief of an abscess of the ovary and Fallopian tube. Of these cases, the operation was completed by the removal of the tumor only in 208; in 78 it was found to be impracticable; in 10 it was performed partially; and in 4 the result has not transpired.

Of 299 cases, in which the result is declared, 179 recovered, and 120 died, or at the rate of a little over 40 per cent. Of the 208 cases in which the operation was completed, 119 recovered, and 89 died, or in the proportion of 42.78 in the 100. Of the 78 cases in which extirpation could not be executed, 55 got well of the operation and 22 died, the result in one not being given. Of the 10 cases in which the tumor was only partially removed, 5 recovered, and 5 died.

Of the 88 cases in which the operation could not be completed, the causes of failure, in 68, were adhesions of the tumor; and of these, 24 died. In 8 no tumor could be found; and in the remainder it was either uterine, pelvic, or abdominal.

The incision, in 117 cases, was short; and of these, the operation was completed in 60, of which 37 recovered, and 23 died. Of the 57 cases in which it was abandoned or incomplete, 44 got well, and 13 perished. Of 143 cases of the long incision, the operation was finished in 123, 72 recovering, and 51 dying. Of the 20 cases in which the extirpation was abandoned, or left incomplete, 11 escaped, and 9 were lost. The average age, in 221 cases, was 34.33 years, the youngest patient being 17, and the oldest 68. Both ovaries were removed in 13 cases, of which 8 proved fatal.

The cause of death is given in 85 of the cases. Of these, 36 perished of peritonitis, 20 of hemorrhage, 12 of exhaustion, 2 of shock, 2 of pneumonia, and 2 of diarrhoea. The mortality was least between the ages of 50 and 60, and greatest under 20. The duration of the disease seems to have exercised considerable influence upon the result of the operation, recovery happening most frequently when the disease had existed between three and four years. There was but little difference in the mortality between the married and single. Finally, the safety of the operation seems to have been greatly lessened by the co-existence of uterine and other diseases.

Dr. Simon has recently reported the results of 64 cases of ovariectomy that have occurred in Germany. Of these, a radical cure was effected in 12, in 6 the operation was merely of temporary utility, and in 46 it was followed by death.

### SECT. III.—AFFECTIONS OF THE VAGINA.

*a.* The vagina is liable to various congenital malformations, inflammation, morbid occlusion, polyps, varix, prolapse, and cystic tumors.

The vagina is sometimes *absent*, as a congenital defect. Of this

variety, I have seen three cases, all occurring in young married women. The breasts in all were well developed, and the sexual desire was quite as strong as in the natural state, thus rendering it extremely probable that there was no defect on the part of the ovaries. A careful examination by the finger in the rectum, and a catheter in the bladder, showed that the septum between these two organs consisted simply of their opposed walls.

The vagina is sometimes very *short*, not, perhaps, exceeding a few lines, half an inch, or an inch. When the defect is associated with absence of the urethra, the tube terminates in a cul-de-sac. Cases occur in which it opens into the bladder, or into the rectum, thus receiving the contents of these reservoirs.

The vagina may be *double*. The septum sometimes extends the whole length of the tube, dividing it into two cylindrical canals, each of which may terminate inferiorly by a separate aperture. Callisen refers to two cases where the canals thus formed were closed each by a perfect hymen. In some instances, which, however, are extremely rare, the frenum is situated transversely, constituting a sort of diaphragm, which prevents the flow of the menstrual fluid.

Finally, the tube may be present, and be well developed, but closed up by solid matter, or the existence of a hymen.

Some of these malformations admit of relief; others do not. Nothing is to be done when there is an absence of the vagina; the woman is impotent, and, therefore, disqualified for marriage. When the tube exists, but is closed by a gristly growth or membrane, surgical interference will be necessary, consisting, generally, in a few simple incisions. When the rectum terminates in the vagina, a proper outlet must be made for it, an operation which is usually quite easy, as the opening nearly always exists very low down. A vagino-vesical opening should be closed by suture.

*b.* The vagina is liable to ordinary and specific *inflammation*. The disease is marked by the usual anatomical characters, and is often attended with profuse discharges of purulent matter, of a very acrid nature, and mixed, at times, with blood. In bad cases, abscesses are formed in the submucous cellular texture; and instances are witnessed where the parts are rapidly destroyed by gangrene. A coating of adventitious membrane is sometimes observed, especially when the inflammation is connected with disease of the mouth and neck of the uterus. Ulcers of the vagina are generally referable to the syphilitic, cancerous, or scrofulous poison, and do not differ from the same class of sores in other regions of the body.

The nature of these lesions may be suspected when there is more or less copious discharge, but can only be positively determined by a careful examination with the speculum.

The *treatment* is antiphlogistic; by rest, purgatives, and light diet, with astringent injections, as solutions of lead, zinc, alum, or copper. If ulceration exist, nitrate of silver, or acid nitrate of mercury may be necessary. Separation of the opposed surfaces with a tent of patent lint, wet with some medicated lotion, or smeared with dilute ointment of the nitrate of mercury, will generally greatly expedite

the cure. The treatment of specific vaginitis is briefly discussed in the section on gonorrhoea.

*c. Occlusion* of the vagina is sometimes observed; chiefly in married females, as a result of severe and neglected inflammation after delivery. Children and young girls, however, are by no means exempt from it. The affection occurs in several varieties of form and degree. In the milder cases, the adhesion generally exists very low down, merely as a slight agglutination of the contiguous surfaces; but under opposite circumstances the union may be complete, reaching from one end of the tube to the other. Such an effect may be the result of ordinary inflammation, and is then a comparatively simple affair, especially if it has not been too long neglected; very frequently, however, it is caused by injury done to the parts during labor, eventuating in gangrene and sloughing, and the ultimate development of an inodular, inextensible tissue, so as to render the case one of an almost hopeless character. Instances occur, although rarely, in which the occlusion is dependent upon a genuine stricture of the vagina, from an effusion of fibrin into its submucous cellular substance. The obstruction, however, is seldom complete.

The only *remedy* for this affection is the separation of the contiguous surfaces, which, as already hinted, is occasionally easy enough. When the case is a slight one, the fingers alone sometimes suffice for the purpose. At other times the operation is readily performed with the handle of the scalpel, aided, perhaps, by a few touches with its cutting extremity. But the task is a very different one when the adhesion is firm and extensive. In such a case nothing but the most patient and cautious dissection will suffice, the knife being carried up in the natural direction of the tube, while the left index-finger is in the rectum and a catheter in the bladder, to serve as guides to the instrument, lest it should penetrate these cavities, and thus cause an intestinal or vesical fistule. Moreover, the operation is not undertaken without due preparation of the system, and a statement of its dangers. I have myself seen two women promptly perish from peritonitis induced by attempts to re-establish the vagina, although I am perfectly certain that the operation could not possibly have been better done in either case. When the canal is merely narrowed by a stricture, a cure may generally be effected by simply notching the resisting part at two or three points.

The after-treatment in these operations must be conducted with great care and vigilance. A well oiled tent of patent lint is inserted, to prevent re-adhesion of the contiguous surfaces, renewal being effected whenever it is demanded by cleanliness. When the cicatrization is completed, a gum-elastic bougie should frequently be introduced, to restore the tube to its normal diameter. When there has been loss of substance of the vagina, even to a slight extent, it will require incessant vigilance to counteract the tendency to contraction and re-adhesion, as I well know from personal observation.

*d. Polyps* are occasionally, though rarely, developed in the walls of the vagina. Tumors of this description may attain a very considerable magnitude, so as not only to distend the whole tube, but project

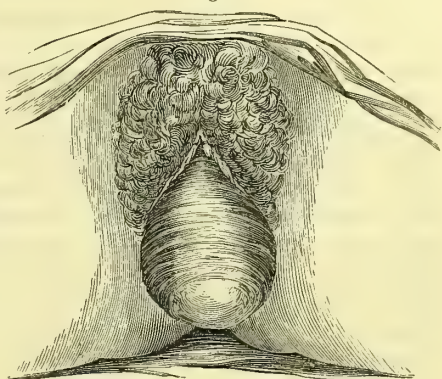


some distance down the thighs. Their weight has been known to exceed ten pounds. The proper remedy is evulsion or ligation.

*c.* The vagina is sometimes covered with *varicose veins*, seated chiefly in the submucous cellular substance. They are spread out in an irregularly arborescent manner, and may be many times the natural size. The coats of the vessels may be entirely healthy, but more frequently they are diseased, being attenuated at one point, and thickened at another. In some cases the lining membrane becomes inflamed, causing coagulation of the blood, and the formation of pus. During parturition, the enlarged veins may be ruptured by the pressure of the child's head, inducing copious hemorrhage. No treatment is generally required in this disease, beyond an occasional purgative recumbency, and the use of cold water.

*f.* *Prolapse* of the vagina is most common after middle age, in married females who have borne children, and who have long suffered under a relaxed condition of the genito-urinary apparatus. The disorder may be limited to the anterior or posterior wall of the tube, or it may embrace its entire circumference. In the latter case, the vagina forms a large tumor, soft, elastic, and of a red, bluish, or lead color, passing beyond the vulva, and hanging down between the thighs, as in the annexed sketch (fig. 551). In prolapse of the anterior wall, there is generally a descent of the bladder, which exhibits itself as a globular or ovoidal swelling at the upper part of the vulva, and which may be greatly reduced in size, if not entirely effaced, by catheterism.

Fig. 551.



Prolapse of the vagina is liable to be *confounded* with protrusion of the uterus and polyps of this organ. The principal points in the diagnosis are the soft and compressible character of the tumor, and its conical, globular, or ovoidal shape. In prolapse of the uterus, the swelling is hard, and the examiner can always readily determine the existence of the orifice of the organ. A polyp is firm, incompressible, and irreducible. In prolapse of the anterior wall of the vagina, constituting what is usually termed *vaginal cystocele*, the tumor enlarges as the urine accumulates, and diminishes during its evacuation.

The *treatment* of this affection consists, in its earlier stages, in the use of astringent injections, and of medicated tents, large enough to oppose the descent of the parts, and retained by an appropriate apparatus. In the anterior protrusion, the bladder should be frequently emptied, to prevent the pressure of the water from forcing down the tumor. When the cystocele is of long standing, or unusually obstinate, an elliptical portion of the mucous membrane of the vagina may be carefully dissected off, and the edges of the wound brought together

by several points of the interrupted suture; the object being retrenchment of the redundant structures. In the posterior descent, special attention must be paid to the state of the bowels, as straining and the impaction of fecal matter are the most frequent causes of the complaint.

*g.* A *cystic* tumor is sometimes observed in this tube, consisting in a morbid enlargement of one of the mucous follicles. I once saw a swelling of this kind immediately beneath the orifice of the urethra of a young lady, the mother of four children. It was of a spherical shape, about the size of a walnut, and of a white, glossy appearance, with a rough, corrugated surface. It had been there for eight years. I opened the tumor freely with a lancet, and let out a considerable quantity of a viscid, glairy fluid, like the white of egg. The fluid never re-accumulated.

#### SECT. IV.—AFFECTIONS OF THE VULVA.

1. *Labia*.—The great lips are liable, during delivery, to *hemorrhagic* infiltration from a rupture of some of the neighboring vessels. The lesion usually involves only one of these organs. The tumor which is thus formed is generally of an irregularly oblong shape, with a dark livid surface, more or less compressible, and about the size of a hen's egg. Occasionally, however, it is much larger, equalling the volume of a foetal head, and containing from ten to twenty ounces of blood. The effusion commonly takes place suddenly, or in a very short time, and, when copious, it almost always makes its escape spontaneously, by lacerating the superincumbent textures, or it remains, and speedily induces inflammation and gangrene. In the latter case, the blood is generally of a very black color, partly fluid and partly coagulated, and emits a highly offensive odor. The infiltrated tissues are sometimes frightfully lacerated, and converted into a dark, shreddy substance, without any trace whatever of their original characters.

When the tumor is small, it will usually soon disappear under cooling, sorbefacient applications, as solutions of acetate of lead, alum, or hydrochlorate of ammonia, along with opium; but, under opposite circumstances, the only effectual remedy is prompt evacuation by a free incision.

The external lip may be the seat of different kinds of *ulcers*, either simple or specific, most commonly seated upon their mucous surface, or at the junction of this surface with the cutaneous. The disease sometimes affects the mucous follicles, the sore presenting itself in the form of a small depression, perhaps not larger than a pin's head. The chancrous ulcer is generally readily distinguished by its history, its large size, its tendency to spread, its obstinacy, and the abundance of the attendant discharge. The common ulcer is often occasioned by want of cleanliness, friction, or disorder of the digestive apparatus.

The *treatment* of ulceration of the vulva must depend upon the nature of the exciting cause. The most important remedies, as a general rule, are frequent ablutions with soap and water, and astringent lotions, applied by means of patent lint in such a manner as to insure

constant isolation of the opposed surfaces. Recumbency, light diet, and purgatives are indispensable auxiliaries. If the ulcers have a tendency to spread, they should be gently touched once a day with a weak solution of acid nitrate of mercury. The indurated chancre may require slight ptyalism.

*Mortification* of the vulva is uncommon. It is most liable to occur in worn-out, intemperate, anemic females, and must be treated upon general principles.

Mr. Kinderwood, many years ago, described a fatal disease of the vulva of young children, which, commencing at one or more points of the mucous surface, rapidly spreads over the nymphæ, clitoris, and hymen. Gangrenous spots appear in a very short time, and continue to enlarge until the parts are converted into dark-colored, fetid sloughs. Great prostration of strength, accompanied by fever and severe pain, is the most prominent symptom of the complaint. The proper treatment consists of tonics, milk punch, anodynes, and the application of the dilute acid nitrate of mercury, with warm water-dressing, simple or medicated.

*Edema* of the vulva is occasionally witnessed; chiefly during the latter months of pregnancy, and in females of a broken constitution, in combination with ascites and anasarca. Enormous tumefaction may thus be produced, terminating, if not timeously relieved, in gangrene. The proper remedy consists in the removal of the exciting cause, and a few minute punctures, to admit of the escape of the pent-up fluid, followed by astringent lotions, or pencilling of the affected parts with dilute tincture of iodine.

*Erysipelas* of the vulva is usually of the œdematous character; the disease is easily recognized by the nature of the pain and swelling, and is treated upon general principles, early and free incisions forming an important element of the management.

*Warty excrescences* are often seen within the vulva. In some instances they extend into the vagina, and down the perineum as far as the margin of the anus. Their number may be very great. I have occasionally counted upwards of a hundred, of all sizes, from that of a mustard-seed to that of a raspberry. Usually they are of a pale, florid color, of a fibro-cartilaginous consistence, rough on the surface, pediculated, and somewhat painful on pressure. Occasionally they are grouped together, running into each other, and thus forming large fissured masses. Their origin, in most cases, is referable to the effects of the gonorrhœal and syphilitic poisons.

The *treatment* is similar to that of warty excrescences upon the penis. The most efficacious remedy is chromic acid, applied every other day, the parts being in the meantime thoroughly isolated. The largest growths occasionally require excision. If the disease is very rebellious, slight ptyalism will be useful.

There is a form of inflammation of the vulva, which, occurring at different periods of life, but especially in married females, has its principal seat in the *mucous crypts*. It usually shows itself in small patches, of a red, almost scarlet complexion, studded with minute points, which are slightly elevated above the surrounding level, and



perfectly distinct from each other. As it progresses, the points increase in volume, and ultimately coalesce, so as to impart to the surface a rough, granulated appearance. At this stage, and, indeed, often before the morbid action has reached this height, some of the glands become ulcerated, the sore looking, at first, like a mere speck, but gradually growing larger and larger until it has acquired the size of a split currant or small pea, its edges being steep, ragged, and, perhaps, partially undermined. The affection is, in every respect, analogous to follicular ulceration of the bowel.

These crypts are liable to chronic inflammation, attended with hypertrophy. When thus affected, they present the appearance of little vesicles, charged with a thick, mucous fluid, not unlike the white

Fig. 552.



of egg, or the contents of the enlarged follicles which we sometimes see upon the lips of the uterus. These appearances are well illustrated in the accompanying cut (fig. 552).

The *treatment* of this affection must be conducted upon general antiphlogistic principles. The most suitable local remedies will be leeches, astringent lotions, and dilute tincture of iodine. In the chronic form of the disease, great relief will be afforded by weak citrine ointment. Rest, light diet, and purgation, will be important auxiliaries.

*Pruritus* of the vulva, or eczema of the mucous mem-

brane of the vulva and vagina, is often met with, both in single and married women, but more especially the latter, and is sometimes a source of the greatest possible distress, the itching being so intolerable that the patient feels as if she could tear herself to pieces. The disease is most common in females with light hair and eyes, and is generally dependent upon disorder of the digestive apparatus. The parts, which are often very dry, have usually a cracked, chapped, or fissured appearance. Minute vesicles, resting on a reddish base, are sometimes seen.

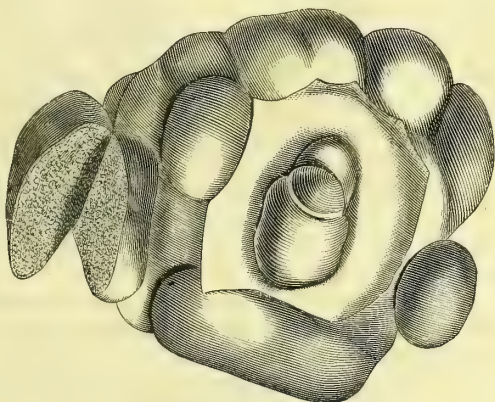
The *treatment* of this affection is very uncertain. The most reliable remedies are steady purgation, a restricted, cooling diet, frequent ablutions, and the application of dilute citrine ointment, with solutions of borax, acetate of lead, and bichloride of mercury, of which the latter is one of the best. Hot water often affords temporary relief. If plethora exist, blood may be taken from the arm, or by leeches from the groins and vulva.

*Polyps* of the vulva are of very infrequent occurrence. They are generally of a pyriform figure, conical, or globular, and attached by a long, narrow pedicle. In their volume they vary between an almond and a child's head, though they rarely exceed that of the fist. Occasionally they are so large as to hang down between the knees. At an early period they are of a spongy consistence, and of a bright florid color; but they are liable to become hard, and to assume a pale, mottled appearance, especially when they project beyond the vulva. Ulceration occasionally occurs, followed by a copious discharge of bloody, fetid matter. Their structure is usually of a soft, fleshy nature, either uniformly, or interspersed with serous cysts, or masses of fibro-cartilage. The only remedy is removal with the knife or ligature.

Finally, it is not uncommon to meet with *occlusion* of the vulva, dependent upon adhesion of the labia, or the labia and nymphæ. The occurrence is sometimes observed in very young children, indeed sometimes in infants at the breast, and is, of course, always a result of inflammation, not unfrequently caused by want of cleanliness, or the accidents of parturition. When the adhesion is slight, it is easily broken up with the probe or finger; when, however, it is extensive, the knife may be required, used prudently, lest more be divided than is proper.

2. *Nymphæ*.—The nymphæ are not often the subjects of disease, independent of that of the great lips. They are occasionally the seat of hypertrophy, or chronic enlargement, so excessive as to require excision, of encysted tumors, and of encephaloid cancer. Of the latter disease, I met with an extraordinary case, in 1842, in a little girl, five years of age, who died, exhausted, at the end of nine months from the first appearance of the tumor. The morbid growth, as seen in the annexed sketch (fig. 553) had extensively involved the lymphatic ganglions of the groin and pelvis. The clitoris was also greatly enlarged.

Fig. 553.



Encephaloid of the nymphæ and clitoris.

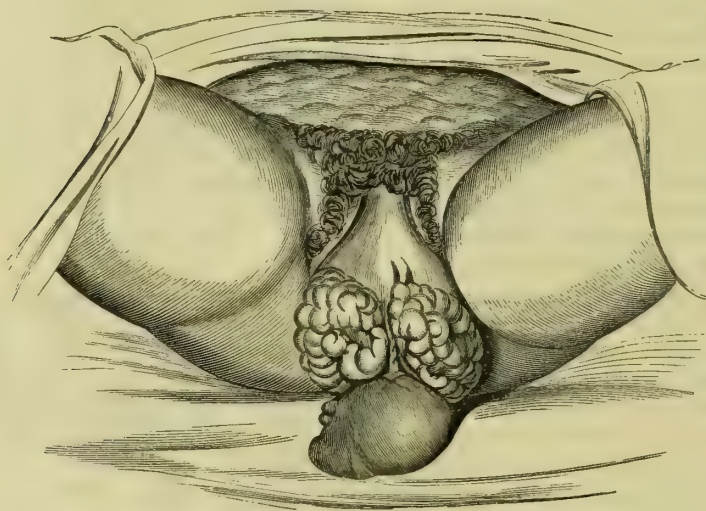
An *encysted tumor*, filled with serum, sometimes occurs in the nymphæ; generally in married females, from the twenty-fifth to the fortieth year. It is soft, fluctuating, of a rounded or ovoidal form, and of variable dimensions, from that of an almond to that of an orange. The diagnosis is easily established by the exploring needle. The most effectual remedy is excision, but a cure may also be effected by the seton and iodine injections.

3. *Clitoris*.—The principal affection of the clitoris is hypertrophy,

which occasionally amounts to such a degree as to become a source of great inconvenience and annoyance. In some countries this organ is naturally much larger than in America and Europe. In Persia, Turkey, and Egypt, hypertrophy of the clitoris is often immense, the tumor thus formed perhaps equalling the size of an adult's head. The disease is sometimes congenital; but generally it is caused by protracted irritation. Courtesans were formerly supposed to be particularly prone to attacks of this kind, but the researches of Parent-Duchatelet, and others, have shown that this is not the fact. When the growth has acquired a large bulk, the only remedy is excision. The operation is usually attended with a good deal of hemorrhage. When the disease is in its infancy, repression may be attempted with cooling and astringent lotions, tincture of iodine, and other sorbefacient means.

The annexed cut (fig. 554) affords a good idea of this affection. The case was associated with hypertrophy of the nymphæ.

Fig. 554.



4. *Urethra*.—The female urethra is rarely diseased. The principal lesions to which it is liable are, stricture, dilatation, and vascular excrescences.

a. *Stricture* is usually situated at the extremity of the tube, and may be so great as to produce much difficulty in making water. In some congenital malformations, the orifice of the urethra opens into the vagina at some distance from the external aperture. Occasionally, as when the mouth of the vagina is closed up by a dense membrane, the urethra is so much dilated as to admit the male organ. These various affections must be met on general principles.

b. *Vascular excrescences* sometimes spring from the female urethra, or are seated around its orifice (fig. 555). They are of a bright scarlet color, exquisitely sensitive under pressure, and of a soft, spongy, erec-



tile structure, with a smooth, fissured, or granulated surface. Their shape is generally pear-like, and in size they vary from a small pea to that of a horse-bean. The disease has been observed in young girls under seventeen, but is most common in adults. Its causes are unknown. The proper remedy is excision, followed by the gentle application of chromic acid.

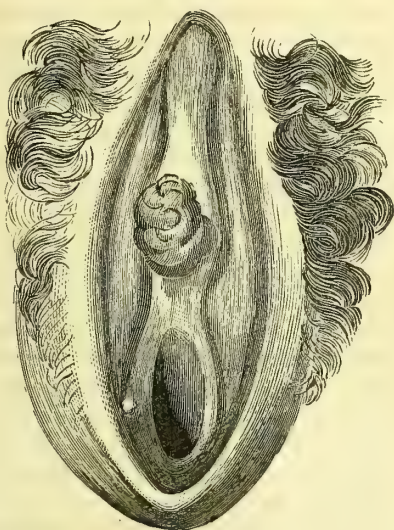
c. Many years ago I assisted my friend, Professor Williard Parker, in removing a *polyp* from the entrance of the urethra of a young lady of eighteen. It was of a conical shape, nearly an inch and a half in length by three-quarters of an inch in diameter, very sensitive, of a bright, florid color, elastic, and compressible. On maceration for a few days, it became perfectly white, and seemed to be composed essentially of soft, cellulo-fibrous substance, pervaded by numerous bloodvessels. Removal of such growths may be effected by ligature or excision.

d. *Inversion and Prolapse of the Bladder*.—Two distinct forms of this affection have been met with, the complete and incomplete; the former consisting in an inversion of all the tunics of the bladder, while, in the latter, the inversion is limited exclusively to the mucous membrane. The immediate cause of both varieties is a relaxed and weakened state of the parts, attended with dilatation of the urethra. The exciting cause is violent and frequent strainings, such as accompany various impediments to the evacuation of the urine and feces. Severe coughing may be mentioned as a predisponent.

In the *treatment* of the incomplete form of inversion and prolapse, the circumstances mainly to be attended to are, first, to enjoin strict recumbency for a long time; secondly, to reduce the tumor carefully, and to counteract afterwards any tendency to protrusion by the frequent use of the catheter, and astringent washes and injections; and, thirdly, to correct the general health by chalybeate tonics and other means. The bowels should be maintained in a soluble condition, and the urine should be voided in the recumbent posture, the patient lying on her side or back. Excision of the protruded part should be studiously avoided, as it might lead to fatal results.

Of the *complete* variety of inversion and prolapse of the bladder, very little is known. The most important signs, in a diagnostic point of view, are the gradual development of the tumor, its soft and fluctuating feel, and the peculiarity of its situation. When we add to these circumstances the fact that there are usually three distinct apertures on the surface of the tumor, corresponding with those of the urethra

Fig. 555.



and ureters, that the tumor is easily reduced by pressure; that the patient is unable to retain her urine; that the part is not particularly tender, sore, or painful; and that there is not, at least not necessarily, any derangement of the general health, the practitioner can hardly fail to detect the true nature of the malady.

In the reduction of the tumor, the patient is placed upon her back, the head and shoulders being elevated, and the thighs, flexed upon the pelvis, widely separated from each other. The labia are then held apart by an assistant, while the surgeon applies his fingers, previously oiled, to the surface of the tumor, and pushes up that part which came down last, the pressure being maintained steadily, but gently, until the whole of it has slipped up behind the pubic symphysis. When the swelling is bulky, and of long standing, it may be necessary to assist these efforts by means of a catheter, applied to the fundus of the bladder, and carried up in the direction of the urethra.

If the tumor has become irreducible, an attempt should be made to diminish its volume and hardness by leeches, fomentations, and other relaxing measures. Chloroform is a valuable adjuvant during replacement.

When the parts are restored, the patient should observe the recumbent posture, the urine should be drawn off frequently, and, if the protrusion be considerable, a compress, confined by a T bandage, should be worn upon the mouth of the urethra. When the patient gets up, she should wear an abdominal supporter.

When the urethra is much dilated, an operation may become necessary. In this case, the inferior portion of the tube may be divested of its mucous membrane, after which the raw surfaces may be approximated by several points of interrupted suture, care being taken to draw off the urine several times a day, until consolidation is perfected.

*f. Catheterism in the Female.*—This operation should always be performed under cover of the clothes, while the patient lies upon her back, near the edge of the bed. Ocular inspection can be justifiable only when the parts are in a state of great disease, or when the tube has undergone much change in its relative position. The best mode of proceeding is to apply the left index-finger to the upper margin of the orifice of the vagina, which thus serves as a guide to the instrument, which is placed upon its palmar surface, and then moved upwards along the middle line, until its point arrives at the dimple-shaped depression, marking the situation of the orifice of the urethra. The catheter is then passed on, with its concavity upwards, until it reaches the interior of the bladder.

The female catheter is made of silver, and is not more than five inches in length. Its vesical extremity is somewhat bent, to adapt it to the shape of the urethra, and is perforated with numerous foramina, instead of having eyelets, as that of the male. The other end is provided with two rings, in order to fasten the instrument, when it is necessary to retain it in the bladder, by means of tapes, to a T bandage.

It has long been known that the female catheter will occasionally slip into the bladder, being suddenly and unexpectedly drawn from the fingers of the surgeon. It is not very easy to explain the reason

of this occurrence. It is, probably, owing to the contractile power of the urethra, aided by capillary attraction, and by the suction of the bladder.

Although, in general, the female catheter is more easily withdrawn than introduced, yet occasionally the reverse is the case. This occurrence is favored by a relaxed condition of the parts, and appears to be directly dependent upon the introduction of a fold of mucous membrane into the eyelets of the catheter. To avoid this contingency, as awkward as it is painful, the instrument should be provided with numerous small apertures, which will effectually prevent the intrusion of the lining membrane, however flabby. The proper remedy is the retention of the instrument until the accumulating urine forces the impacted folds into their natural situation. All attempts at forcible extraction should be avoided.

#### SECT. V.—GONORRHOEA IN THE FEMALE.

Gonorrhœa in women is a very different affection from gonorrhœa in males; in the latter, the disease is generally exclusively confined to the urethra, or it exists simultaneously in this canal and on the head of the penis. In the female, on the contrary, it usually expends its force upon the lining membrane of the vulva, vagina, and uterus, the urethra being seldom implicated to any considerable extent. The parts which are generally most violently inflamed are the mucous follicles around the urinary meatus, and the upper portion of the vagina. Occasionally the disease extends into the cavity of the uterus, and thence, there is reason to believe, along the Fallopian tubes and ovaries, the attack thus presenting an analogy with gonorrhœa in the male, eventuating in epididymitis. The interior of the uterus is most liable to become affected in those females in whom that organ has an uncommonly large mouth, thereby allowing the more easy entanglement and retention of the gonorrhœal virus. The occurrence is, however, under any circumstances, unusual. The time which elapses between the contamination and the outburst of the disease is generally somewhat shorter than in men, owing to the fact that the poison is brought in contact with a larger surface. The disease may be simple or complicated; it is more frequently associated with chancre than in the male, and is often followed by excoriations and simple ulcers, especially of the neck of the uterus, and lower extremity of the vagina.

The *symptoms* of the disease are essentially similar to those which characterize gonorrhœa in the male. The parts, at first the seat of itching and smarting, soon become hot, swollen, painful, and affected with muco-purulent discharge, often bloody, usually excessively profuse, and, at times, quite fetid and even acrid. The scalding in micturition is considerable, though rarely as great as in the male, and the labia, nymphæ, vagina, and the neck of the uterus, are frequently covered with aphthæ, fissures, and excoriations. In the more severe forms of the disease, there are a sense of weight and fulness in the lower part of the pelvis, and aching pains in the groin, thigh, and perineum. The



lining membrane of these parts is of a fiery red color, and covered, here and there, with patches of lymph, of a pale-yellowish hue, tough and stringy, and firmly adherent to the surface beneath. During the progress of the attack, the lymphatic ganglions in the groin are apt to suffer, becoming sore, and swollen; and so much pain and tenderness is often experienced in walking as to compel the woman to keep her bed. Occasionally the inflamed surfaces, instead of being bathed with pus and mucus, are remarkably dry, and the distress is then often proportionably much greater.

The *diagnosis* of gonorrhœa from other affections, especially leucorrhœa, although most desirable, is frequently very difficult, and sometimes altogether impossible. The distinction is particularly important on account of its medico-legal relations, females laboring under discharge of the genital organs being often suspected of having gonorrhœa, when, in fact, the disease is only of an ordinary nature. In general, the difficulty may be solved by the history of the case, the moral character of the woman, the nature of the discharge, and the presence or absence of complications. In leucorrhœa, with which the disease is most liable to be confounded, there is seldom any discharge from the urethra, or scalding and smarting in micturition; in gonorrhœa, on the contrary, these two symptoms usually exist in a very marked degree. In leucorrhœa, the disease is mostly confined to the vagina and uterus; the discoloration, although considerable, is seldom either great or uniform, and the vulvo-uterine canal is usually free from ulceration. In gonorrhœa, the inflammation always involves the labia and nymphæ; the redness is of a fiery hue, and extensively diffused, the parts having almost an erysipelatous aspect, and marked abrasions, excoriations, or superficial ulcers are nearly constantly found upon the neck of the uterus, as well as upon the vagina. Finally, in leucorrhœa the pain is comparatively slight, and there is no disease of the lymphatic ganglions of the groin, the reverse being the case in gonorrhœa.

In attempting to form an accurate diagnosis of these diseases, too much caution cannot be exercised, otherwise there will be great danger of occasionally involving the innocent. A thorough examination should always be made with the speculum, not once, but repeatedly, and the moral character of the woman should, in every instance, receive due consideration. If the patient be very young, or of an age when there are usually no sexual propensities, it may be presumed that the discharge is the result purely of simple vaginitis, occasioned by want of cleanliness, the presence of worms in the lower bowel, derangement of the digestive apparatus, or an anemic state of the system. All vaginal discharges are acid, and intermixed with abraded epithelium; but neither the microscope, nor any chemical test at present known, is of any avail in determining whether they are of an ordinary or a contagious character.

The *treatment* of gonorrhœa in the female must be of a strictly antiphlogistic character, until there is a marked diminution of discharge and local distress, when trial may be made of copaiba, or copaiba and cubebs, though, owing to the fact that the disease is rather a vulvo-

vaginitis than a urethritis, these articles generally exert very little, if any influence, in controlling the morbid action. The patient should be confined to her bed, and, if plethoric, be freely bled at the arm, especially if the inflammation run very high, as denoted by the severity of the pain, and the sense of weight and fulness in the pelvic region, together with the profuseness of the profluvia. The venesection should be followed up by a brisk cathartic of the compound calomel pill, or an infusion of senna and sulphate of magnesia; and as soon as the bowels have been thoroughly relieved, recourse should be had to the antimonial and saline mixture, given every three or four hours, according to the exigencies of the case. The diet must be perfectly light and simple, as well as duly restricted in quantity.

The local treatment must be in strict consonance with the activity of the morbid action. If this be high, leeches must be applied in considerable numbers to the groins, vulva, and inside of the thighs; and in all cases the utmost attention must be paid to cleanliness by the frequent use of tepid ablutions and injections of tepid water, containing a little alum, soda, common salt, or acetate of lead. If the discharges be offensive, a small quantity of liquid chlorinate of soda may be added to the water. Great care should be taken that the lotions, whatever be their composition, are not too strong, particularly at the commencement of the treatment, lest they should tend to increase the morbid action instead of diminishing it. Although the female organs of generation bear stimulating injections much better than those of the male, yet there is no doubt that, unless well tempered, they often do immense mischief. Observation has taught me that it is impossible to pay too much attention to this subject. Another practical precept worthy of notice is that the inflammation will subside much more rapidly, other things being equal, when the affected surfaces are kept well separated, than when they are permitted to be constantly in contact with each other, the warmth and the accumulation of the matter thus occasioned having a tendency to maintain the disease in full vigor. To effect this object, a large tent of patent lint, wet with some gently astringent lotion, as a solution of sulphate of alum, or acetate of lead, should be retained constantly within the vagina, being changed from time to time, as cleanliness and other circumstances may render it necessary. When the inflammation has passed into the subacute or chronic state, the lotion may be dispensed with, and the tent smeared with an ointment composed of one part of the ointment of nitrate of mercury to eight parts of simple cerate. Under the influence of this application, when the disease has reached this point, all discharge generally ceases in a few days. When ulcers exist upon the neck of the uterus, or upon the vulvo-vaginal mucous membrane, it may be necessary to touch them gently every third or fourth day with the solid nitrate of silver, or, what is preferable, with the dilute acid nitrate of mercury, the best formula being that of Bennett. The same rule, in regard to the continuance of the treatment, after all discharge has been arrested, should be observed here as in gonorrhœa of the male. The exhibition of copabia and cubebs is indicated chiefly when the urethra is much implicated; for, as already intimated, the peculiar anti-gonorrhœal

virtues of these articles do not display themselves at all when the disease is confined to the vulva, vagina, and uterus. If buboes arise during the course of the disease, they are to be treated in the usual manner.

Abscesses are very apt to form in the labium, in the more severe forms of gonorrhœa, and should always claim early attention, as they are generally excessively painful, and are liable, when neglected, to occasion serious structural lesion. Their contents are usually excessively fetid, and of a thick, purulent character.

#### SECT. VI.—URINARY FISTULES.

The bladder of the female is liable to various kinds of fistules, deriving their names from the organs with which they communicate, as vesico-vaginal, urethro-vaginal, vesico-uterine, vesico-utero-vaginal, and vesico-rectal.

The most common *cause* of this affection is the accidental laceration of the parts during parturition in consequence of the pressure of the child's head, especially if the accoucher has neglected to empty the bladder. It is also produced, though, probably, less frequently than is generally imagined, by the maladroit use of instruments, inducing either direct rupture, or such an amount of contusion as to eventuate in gangrene and sloughing; by penetrating wounds of the vagina and bladder, and by ulceration, whether occasioned by abscess, simple, syphilitic, or malignant disease, or the pressure of a urinary calculus, a pessary, or any other foreign body.

The different classes of vesical fistules do not occur with equal frequency. Dr. Bozeman, who, as is well known, has paid much attention to the study of the subject, informs me that the examination of a large number of cases justifies him in stating that the vesico-utero-vaginal form of the lesion is decidedly the most common; next in point of frequency is the fistule established at the expense of the vesical trigone; then comes the opening situated at the *bas-fond* of the bladder; then the urethro-vaginal fistule; and, lastly, the fistule formed by the destruction of a part or the whole of the vesical trigone, and the wall of the urethra, of the trigone and *bas-fond*, or, finally, of all these parts together.

A great deal of diversity obtains in regard to the size, shape, and number of vesical fistules. Thus, the opening may not exceed the diameter of a small shot, or it may be so large as to admit a pullet's egg, or even a small orange. In its shape it is generally somewhat oval or circular, but occasionally it presents itself in the form of a transverse, oblique, or longitudinal rent, slit, or fissure. Its edges are usually well defined, rough, callous, and white, with a slight eversion of the vesical mucous membrane. The induration often extends a considerable distance beyond the fissure, especially when this has been caused by sloughing, and it is, therefore, occasionally very difficult to pare the edges of such an opening. The vagina in the neighborhood of the aperture may be perfectly sound, or it may be variously altered by disease, according to the nature of the exciting cause of the fistule,



the violence of the resulting inflammation, and the acrid character of the discharges. It is not often that there is more than one opening.

A singular eversion of the bladder occasionally takes place in vesico-vaginal fistule, the lining membrane passing across the abnormal aperture so as to form a tumor in the vagina. The protrusion, which is seldom considerable, is generally of so trifling a nature as not to require any special attention. When, however, the artificial opening is unusually large, the whole bladder may project through it, and eventually even protrude at the vulva, as in the remarkable case mentioned in my work on the Urinary Organs.

A female affected with vesico-vaginal fistule must necessarily be an object of the deepest commiseration. Incapable of controlling the contents of her bladder, the urine constantly escapes at the vagina, thus soiling her clothes, and giving rise to the most noisome odors, which no amount of cleanliness can entirely prevent. In consequence of this condition, she is rendered unfit for social enjoyment, and is obliged to spend her life in solitude and retirement. But this is not all: the urine, incessantly dribbling away, chafes and frets the parts with which it comes in contact, and thus renders them unfit for the exercise of their appropriate functions. The escape of urine is constant when the opening is situated at the bas-fond of the bladder, and is always worse in the erect than in the recumbent posture.

The *diagnosis* of this affection is, in general, sufficiently easy. In most cases, indeed, the escape of the urine by the vagina, instead of through the natural channel, serves at once to point out its true character, whatever may have been the nature of the exciting cause. Its situation, shape, and extent, however, can be determined only by a thorough vaginal examination by means of the speculum, the woman lying on her back, or, what is better, resting on her knees and forearms, with the head as dependent as possible, and the nates considerably elevated. The instrument, well oiled, is then introduced in the usual manner, a catheter being at the same time inserted into the urethra. In this way every portion of the vagina may be most satisfactorily inspected, and any opening, however small, easily detected. In some instances, the speculum is advantageously replaced by the finger, which is carried about in different directions, along the anterior wall of the tube, until its extremity comes in contact with the naked end of the catheter. When the aperture is very small, a long, slender probe should be used instead of the latter instrument.

The *prognosis* of vesico-vaginal fistule is, in general, anything but flattering. If a spontaneous cure do occasionally occur, the circumstance is so infrequent that it must always be regarded merely as an exception to one of the most uniform laws of the animal economy. The probability of such an event will be considerably greater, other things being equal, when the accident has been produced by a simple wound than when it has been caused by a severe contusion, followed by a slough, when the opening is small than when it is large, and when the lesion is simple than when it is complicated. The presence of malignant disease forbids the hope even of temporary relief by any operation whatever.

The *treatment* of this affection is palliative and radical; the former consisting in the employment of such means as are adapted to promote the patient's temporary comfort, while the latter are designed to effect the permanent obliteration of the abnormal opening. Frequent ablutions and injections with cold water, either simple or medicated, and the occasional use of chloride of soda, will prevent excoriations and noisome fetor, and a proper regulation of the diet, with a soluble condition of the bowels, will go far in preserving the general health, which, under opposite circumstances, sometimes suffers most severely, the patient becoming nervous, dyspeptic, and hysterical. To guard against the incessant escape of the urine, and enable the poor patient to exercise occasionally in the open air, the vagina should be kept constantly filled with a hollow plug, or caoutchouc bottle, enveloped in oiled silk, and furnished with a tube and stopcock, in order that it may be inflated or emptied at pleasure. Or, instead of this a reservoir, such as that represented at page 820, may be suspended from the vulva.

The *radical* treatment of vesical fistules has recently been brought to a high degree of perfection, almost exclusively by the labors of two practitioners, Dr. Sims, of New York, and Dr. Bozeman, of Alabama, the former of whom led the way in this laudable enterprise, while the latter has materially assisted in improving it by the invention of a highly ingenious suture. Previously to this, occasional cures of this loathsome affection had been effected by different American surgeons, especially by Dr. Hayward, of Boston, Dr. Mettauer, of Virginia, and my colleague, Professor Pancoast. In the account which I am about to give of this operation, I shall limit myself chiefly to Dr. Bozeman's process, both because it is extremely efficacious, and because he has kindly placed at my service a complete set of drawings illustrative of its various stages.

The suture of Dr. Bozeman, which has already done such ex-

Fig. 556.

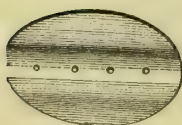


Fig. 557.



cellent service, is called the button suture, and is composed, first, of a piece of sheet lead, generally of an oval shape, perforated by several apertures, about the third of a line in thickness, and variously bent, in order to adapt it to the shape of the parts; second, silver wire, very delicate and flexible, each thread being eighteen inches in length; and third, leaden crotchets, to retain

the apparatus in place. The annexed figs. 556 and 557, afford a good illustration of the more ordinary forms of the button.

Before any operation of this kind is undertaken, it is indispensable that the patient should be subjected to a certain amount of *preliminary treatment*. Without this precaution failure, not success, will be likely to attend our efforts. The treatment need not be protracted, but it should be thorough, both as it respects the parts and the system at large. The most absolute recumbency and cleanliness should be observed; the vagina should be frequently syringed with cold water; cold cloths should be kept constantly upon the vulva; the bowels and secretions should be properly regulated; the diet should be perfectly

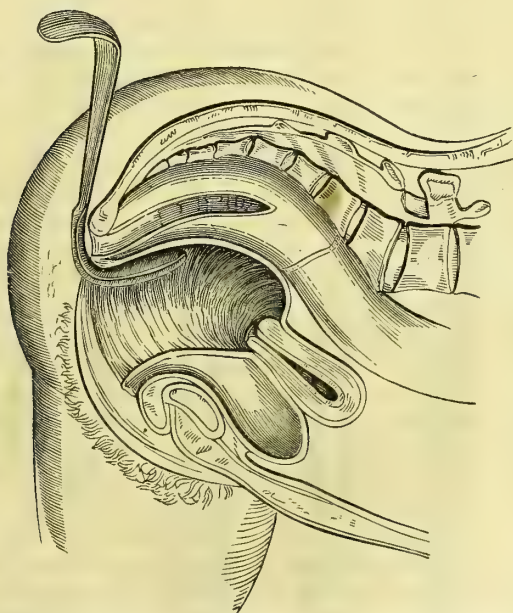
plain and simple; and large quantities of demulcent drinks should be used to dilute the renal secretion, and deprive it of its acrimony. If the woman be plethoric, blood should be taken from the arm, or from the vulva, perineum, groins, and thighs, by means of leeches. Thus prepared, she will be able to bear the operation with greater impunity, and with a better prospect of a favorable issue.

If the parts are much inflamed, they should be touched, every other day, with a solution of nitrate of silver, in the proportion of thirty grains to the ounce of water, until the disease has measurably disappeared. If any contractions exist in the vagina, they must be thoroughly divided, care being, of course, taken, while this is being done, not to penetrate the bladder, rectum, or pelvic cavity.

When the neck of the uterus is imprisoned in the bladder, an effort must be made to reinstate it in its natural position, as well as to relieve it of inflammation, before attempting to close the fistule. For this purpose, the cervix, as Dr. Bozeman suggests, is drawn down by means of a blunt hook inserted into its mouth, at the same time that the fundus of the organ is dislodged from its position between the vagina and rectum with a sponge mop, the woman, meanwhile, resting upon her knees and arms, so as to bring the parts fully into view. While held in this position, a tent, such as that described in a previous page, is introduced, renewal being afterwards effected once a day, preceded by injections of cold water, until the uterus is disposed to maintain its place, when the operation is proceeded with.

The *position* of the patient is a matter of paramount importance. When she is obliged to take chloroform, as may be the case when she is very timid, she must lie upon her back, as in the operation of

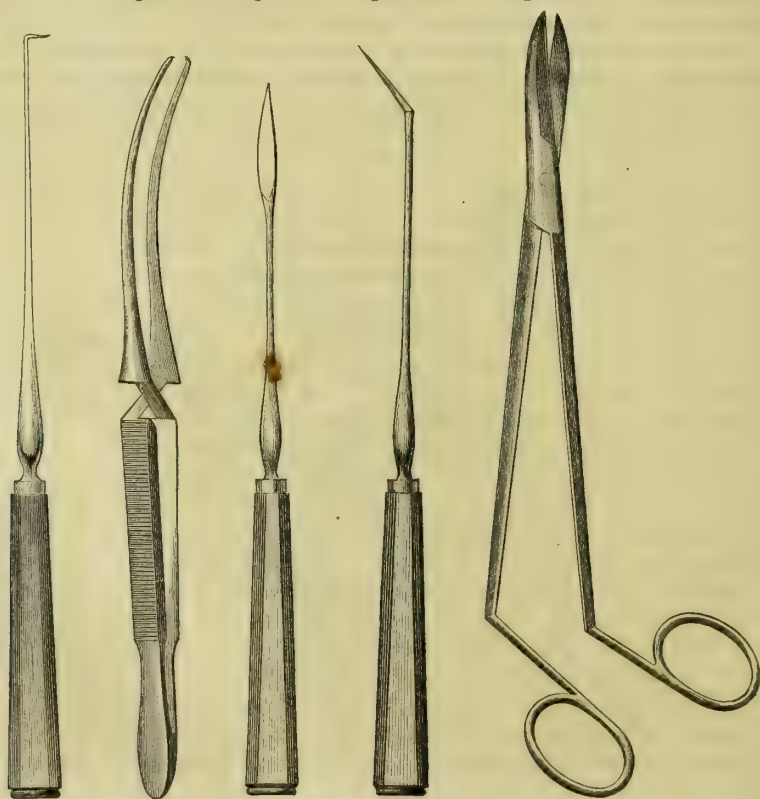
Fig. 558.





lithotomy; but it will be far better, as it respects a full and ready view of the parts, for her to rest upon her knees and forearms, upon a couch, or a low, narrow table. In this manner, the head and shoulders being depressed, the nates may be elevated to any convenient height, and the light so arranged as to fall directly upon the vesico-vaginal septum in its entire length. The thighs, separated about eight inches from each other, should form a right angle with the table, and the clothing should be so light and loose as to take off all pressure from the abdomen and its contents, which will thus tend to gravitate towards the epigastric region. An assistant on each side lays a hand in the fold between the gluteal muscles and the thigh, the ends of the fingers resting upon the great lips. The nates being now simultaneously pulled upwards and outwards, the air rushes into the vagina, widely dilating it, and so affording an easy view of the fistule, as well as of the mouth of the uterus. The exhibition will be rendered still more perfect if the perineum, the sphincter muscle of the anus, and the recto-vaginal septum be well raised with the duck-bill speculum of Dr. Sims, of which there should always be at least two sizes. Fig. 558 shows the application of the instrument, the position of the thigh and nates, the appearance of the dilated vagina, and the situation of the uterus, the bladder, and vesico-vaginal septum. If the light should

Fig. 559.      Fig. 560.      Fig. 561.      Fig. 562.      Fig. 563.



be insufficient, a small mirror may be used, the reflection of which will generally render everything perfectly distinct, and enable the operator to proceed without any embarrassment from this cause.

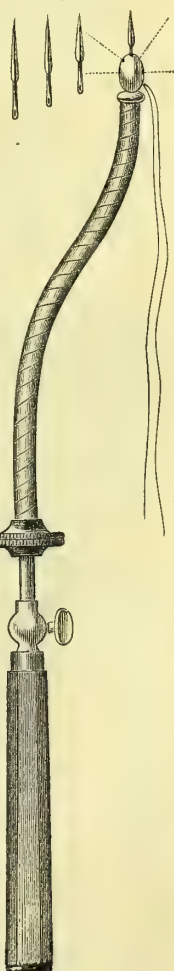
Everything being thus arranged, the surgeon begins to pare the edges of the fistule, a procedure which always requires great care and judgment. As a general rule, the edges should be well bevelled at the expense of the vaginal mucous membrane, as this will afford a more extensive surface for agglutination, and also admit of more firm approximation on the vesical side of the septum. If the opening is circular, unusually large, or vertical, the edges should always be sloped in such a manner as to allow them to be brought together transversely, otherwise thorough union will be impossible. The instruments necessary for the easy performance of this part of the operation are a delicate tenaculum, long, slender, toothed forceps, a straight and angular knife, and curved scissors, represented in figs. 559, 560, 561, 562, and 563. The anterior edge of the fistule is pared first, and the best instrument for this is the straight knife, the necessary quantity of substance being taken away in one piece. For refreshing the posterior edge, the curved knife or scissors will be found most convenient. If the opening be very large, this stage of the operation is sometimes interfered with by the protrusion of the vesical mucous membrane, but the obstacle can usually be easily overcome by returning the part, and then filling the bladder temporarily with bits of sponge.

The next step of the operation consists in introducing the sutures, the number of which must necessarily vary according to the extent of the fistule. The instruments required for this purpose are a stout, straight, spear-pointed needle, a needle-holder, a pair of long, curved forceps, and a small hook.

The needle-holder, represented in fig. 564, is composed of a clasp with a curved shaft, over which slides a flexible canula. This is set in the socket of a handle, and secured there by a thumb-screw which allows the whole to be separated for cleansing after use. During the operation the shaft may be bent to any extent that may be desired. The instrument is shown with a needle armed with a silk thread, and ready for use. Several needles, ranging from half an inch to an inch in length, should always be at hand.

The distance at which the needle is entered from the anterior edge of the fistule should not be less than a third of an inch, as the object is to take a very firm hold. The instrument is pushed steadily on, and brought out in the submucous cellular substance of

Fig. 564.



the bladder, counter-pressure being made against its advancing point by the little hook represented in fig. 565. The needle is now disengaged from the clasp of the holder by sliding back the canula with

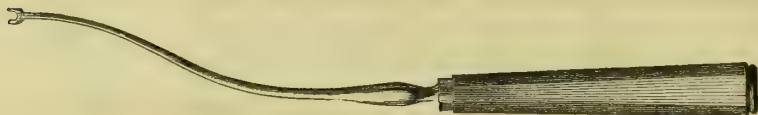
Fig. 565.



the thumb, when its point is seized and drawn out with a pair of curved forceps. Being re-inserted in the clasp, it is then carried across the fistule, and entered at the posterior edge, which it traverses in the same manner as the anterior one, being brought out precisely at the same distance, counter-pressure and disengagement of the needle being effected as before. Thus suture after suture is introduced, until the number is completed, the interval between each two being about three-sixteenths of an inch.

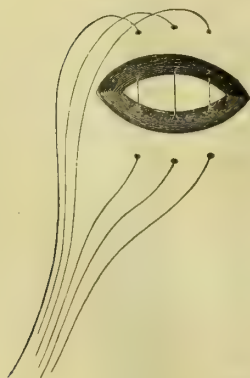
Each thread is now fastened by its proximal extremity to a loop near the end of the silver wire by which it is to be replaced, the knot being pressed down smoothly with a pair of forceps, and well oiled to facilitate its passage across the track made by the needle. The wire is then pulled in its proper place, the posterior edge of the fistule

Fig. 566.



being steadied, while this is being done, with the fork, shown in fig. 566. This mode of introducing the sutures is far superior to that of introducing the wire separately. This part of the operation is exhibited in fig. 567, in a transverse fistule requiring three sutures.

Fig. 567.



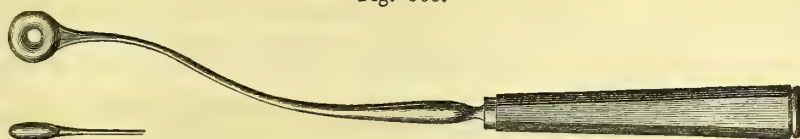
The tying of the sutures, and the arrangement of the buttons, constitute the third stage of the operation. This is easily done with the aid of an instrument, represented in fig. 568, and which Dr. Bozeman calls the suture-adjuster. It consists of a strong rod, curved in the shaft, and set into a handle, its distal extremity being perforated and somewhat bulbous. The opposite ends of each wire are now passed through the opening in the instrument, and firmly held between the thumb and forefinger of the left hand, when the adjuster is carefully slipped down until it comes in close contact with the tissues beneath. Fig.

569 shows the appearance of the parts after all the sutures have been adjusted, and the edges of the fistule approximated. A button, of suit-



able shape and size, having previously been provided, is now placed

Fig. 568.



upon the wires, as seen in fig. 570; its concave surface corresponding to the vesico-vaginal septum, with which it is brought in close contact

Fig. 569.

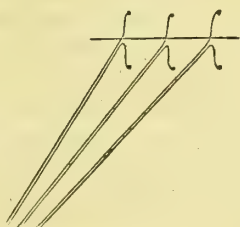
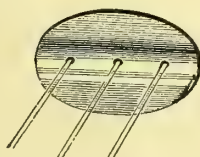


Fig. 570.



by means of the instrument represented in the annexed cut (fig. 571), the angular and scalloped extremity of which admirably adapts it for that object. The crotchet is now slipped down over the approximated

Fig. 571.



ends of each suture, as illustrated in fig. 572, and pressed firmly against the convex surface of the button by means of a pair of forceps, to keep the button in place, and the edges of the wound thoroughly united. Finally, the operation is completed by clipping off the wires

Fig. 572.

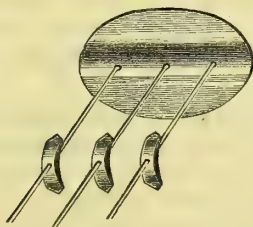
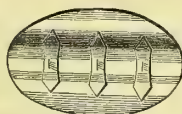


Fig. 573.



close to the crotchet, and turning down their short ends, as delineated in fig. 573.

Certain *modifications* of this operation are frequently necessary, growing out of the situation of the fistule, or the condition of the parts. Thus, as Dr. Bozeman has so well pointed out, in the urethro-vaginal lesion, the button must be rather long in the antero-posterior

direction, very concave, and extend well forward in front of the urinary meatus, so as to support the catheter, its extremity being somewhat notched. The edges of the opening are brought together transversely; and the catheter, a gum-elastic one, is introduced before the sutures are adjusted, and is retained, if possible, until the cure is completed.

In fistules involving the vesical trigone and the root of the urethra, or of the trigone and bas-fond, or of all these parts together, in which the anterior border of the opening is immovably fixed to the pubic arch, with the concavity presenting backwards, the button requires to be bent upon its convexity.

Considerable modification is required when the fistule extends into the neck of the uterus. The paring of the edges being effected in the usual manner, the button is carefully adapted to the shape of the parts, its posterior border being generally notched to accommodate the anterior lip of the cervix. A semi-circular button is required when there has been so much loss of substance of the vesico-vaginal septum as to render it impossible to draw the anterior border of the fistule up to the posterior. The line of perforations corresponds with the former border, while the notch in the button projects over the anterior lip of the neck of the uterus.

When the neck of the womb is lacerated, and buried in the bladder, the first object is to restore the organ to its natural position in the vagina, in order that, after the cure is completed, the menstrual fluid may resume its natural outlet. To do this it is necessary to enlarge the fistule in the vesico-vaginal septum on each side, transversely, thus disengaging the organ somewhat, and affording more space for paring the anterior lip of the cervix. In inserting the sutures in the poste-

Fig. 574.



rior border, the vesical mucous membrane is pierced by the needle, which, being carried into the bladder through the fistule, is entered far in on the vesical side of the cervix, and brought out from behind forwards, the object of the procedure being to obtain such a hold upon the womb as to enable the operator to pull its neck downwards and backwards during the adjustment of the sutures, restoration of the displaced organ being impracticable in any other way. The button for this variety of fistule requires to be bent upon its convexity, and to be notched above for the support of the anterior border of the neck of the uterus.

During these various operations, which must necessarily be more or less tedious and fatiguing, both to the patient and the operator, great advantage will be derived from the use of several sponge mops, of various shapes and sizes, for wiping away the blood and the secretions. The bleeding is usually insignificant, and readily stops of its own accord. The operation being over, a Sims's catheter (fig. 574) is inserted into the bladder, care being taken that the outer extremity projects sufficiently far beyond the vulva to allow a vessel to be placed beneath it to catch the urine.

Much of the success of this operation, and, indeed, of every other of a similar kind, will depend upon the *after treatment*. As soon as the patient is put to bed, she should take a large anodyne, for the twofold purpose of allaying pain and inducing quiescence of the bowels, which, in no case, should be disturbed under ten, twelve, or fifteen days. The diet should consist exclusively of tea and crackers, custard, rice, and jelly, with water as the common drink. Opium is given twice a day in as large doses as can be borne, and the patient is never permitted, even for a moment, or for any purpose whatever, to assume the erect posture, though she may, if she prefer it, lie on either side. The catheter is to be removed as often as may be necessary to keep it clear of mucus and calculous matter; once a day, once every other day, or once every third day, according to the circumstances of each individual case. The vulva and orifice of the vagina should be syringed at least twice in the twenty-four hours with cold water, a large bed-pan being placed under the nates during the operation to receive the fluid as it runs off. Should undue inflammation arise, leeches and even the lancet should be called into requisition, and that with the least possible delay; purging is still carefully avoided, especially if there be no marked derangement of the digestive organs, and the utmost attention is paid to cleanliness. Both the part and system are occasionally endangered by erysipelas. In a patient under my charge several years ago, although more than usual care had been bestowed upon the preliminary treatment, a most violent attack of this disease took place within a few days after the operation, commencing on the right buttock, and gradually spreading over the upper part of the thigh, perineum, and vulva, from which it speedily extended into the vagina, causing large deposits of lymph, with a strong disposition to cohesive action. The constitution suffered very much, and at one time I was not without serious apprehension in regard to the ultimate issue of the case. Notwithstanding all this, however, the woman made a good recovery, though several months elapsed before she fully regained her strength.

Peritonitis has occasionally occurred after this operation, and it is well enough always to have an eye to the possibility of such an event; so that, should it show itself, it may be promptly combated. It will rarely appear before the third day, or after the sixth or eighth.

The sutures should not be removed, on an average, before the ninth or tenth day; if taken out sooner, the adhesions will be apt to give way, and thus necessitate a repetition of the operation. The patient being placed in the same position as in the first instance, the ends of each suture are clipped with a pair of curved scissors, when the button is lifted off, and the wire gently drawn away by taking hold of its proximal extremity, previously well separated from the other. The patient, instead of sitting up or walking about, observes the recumbent posture for several days longer, and the use of the catheter is continued until there is reason to believe that the new cicatrice has acquired sufficient strength to resist the pressure of the distended bladder and the traction of the surrounding parts.



With regard to the *results* of this operation, we have unfortunately no statistics on an enlarged scale. In a communication, kindly addressed to me last spring, Dr. Bozeman informed me that he had operated altogether upon 33 patients, of whom 29 had been completely cured, 2 were still under treatment, 1 was incurable, and 1 had died. The whole number of fistules was 44, of which 40 had been completely closed, 3 had re-opened after having been closed, and 1 refused to unite.

Although I believe that the process above described is by far the best that has yet been devised for the relief of this affection, it cannot be denied that excellent cures are occasionally effected without it, simply by the ordinary thread or wire suture. If I am not misinformed, Dr. Sims now operates altogether with the latter, without the aid of clamps, the use of which was once so much insisted upon by him; and Dr. Agnew, of this city, has recently succeeded in several cases by a similar procedure.

A *vesico-rectal fistule* occasionally occurs as a result of wounds, ulceration, abscess, or malignant disease. The characteristic sign of the lesion is an interchange of the contents of the two contiguous reservoirs, the urine passing into the bowel, and the feces into the bladder. In consequence of this occurrence, the parts are apt to become sore and irritable from the contact of substances which are entirely foreign, and, therefore, injurious to them. Moreover, the constant introduction of fecal and other matter into the bladder is liable to give rise to calculous concretions, and to retention of urine.

The more simple forms of this affection will often disappear of their own accord. In all cases, the bowels should be maintained, for days together, in a perfectly quiescent state by morphia, opium, or laudanum, and the rectum should be washed out several times in the twenty-four hours with cold water, or, if the discharges be fetid, with a very weak solution of chlorinate of soda. The recumbent posture should be carefully observed; the diet should be of the most bland and simple character; and drinks of every description should be used as sparingly as possible. As the case progresses, the closure of the fistule may often be greatly promoted by the constant retention of the catheter, which thus conducts off the urine as fast as it reaches the bladder, and, of course, prevents it from passing into the bowel.

If nature fails to accomplish her purpose, a cure may not unfrequently be effected by the use of nitrate of silver, acid nitrate of mercury, or the actual cautery, applied through the intervention of an anal speculum. In very obstinate cases, especially when the abnormal opening is situated very low down, the edges may be pared, and united by suture, as in vesico-vaginal fistule; the parts being previously dilated by the bougie, and widely opened at the time of the operation by means of blunt hooks. When this proceeding does not afford the requisite room, it would be perfectly proper to divide, as a preliminary step, the sphincter muscle.

Some years ago, I met with a case of *vesico-vagino-rectal fistule*, the patient being a woman, aged twenty-seven. The accident occurred during a protracted labor. For the first twelve months, the urine

dribbled off constantly by the anus; but after that period, she was able to retain it for half an hour, or even an hour, at a time, especially when in the erect posture. The rectum, which thus served the purpose of a sort of accessory reservoir for the urine, was unusually tender and irritable, while the anus constantly exhibited an inflamed and excoriated appearance. After the re-establishment of menstruation, that function was always performed with great regularity, though rather sparingly, at every lunar month, generally lasting about three days. The catamenial fluid, which was of the natural color, was discharged by the anus. The urethra presented nothing peculiar at its orifice, but all attempts to pass an instrument, even the smallest pocket-probe, proved abortive.

Finding it impossible to restore the vagina, I introduced a large curved trocar into the urethra, for the purpose of re-establishing the natural channel for the urine. The operation was performed without difficulty, the woman being under the influence of chloroform, and a self-retaining catheter was immediately inserted into the bladder. By wearing this, off and on, for several weeks, the passage was completely restored to its former size, the urine being discharged in as full a stream as ever, and that not oftener than five or six times in the twenty-four hours. The fact is, she had the most thorough control over the bladder, the general health was excellent, and not a drop of urine was voided by the anus. The menstrual fluid passed off by the bladder.

#### SECT. VII.—LACERATION OF THE PERINEUM.

Laceration of the perineum, usually a casualty of parturition, in consequence of the large size and rapid descent of the child's head, or the maladroit use of instruments, occurs in various degrees, from the slightest division of the skin and mucous tissues, to the union of the vagina and rectum into one cavity. In the latter case, there is, of course, more or less involvement of the recto-vaginal septum, the rent, perhaps, reaching up from six to eighteen lines. Owing to the laceration of the sphincter muscles of the anus, an accident which always necessarily attends the worst forms of the lesion, the woman has seldom any control over her bowels.

The *treatment* of this affection varies according to its extent and character. The more simple forms will generally promptly get well of their own accord, especially if proper care be bestowed upon them soon after their occurrence, in the way of rest, thorough approximation of the limbs, and cleanliness, assisted by light diet and constipation of the bowels. When the rent is extensive, recourse must be had to the quilled suture, the stitches being introduced very deep, and retained until there is a certainty of complete adhesion of the opposed surfaces. A similar plan of treatment is employed when the case has been neglected, but, in addition to this, it will be necessary, before arranging the ligatures, to see that the edges of the fissure are properly refreshed.

This is usually easily done with the bistoury and forceps, aided with the scissors. The raw surfaces should not, on an average, be less than two inches in length by from nine to twelve lines in width. The borders of the recto-vaginal septum are also well pared, and carefully united, as a preliminary step, two stitches always sufficing for the purpose. In sewing up the perineal portion of the fissure, at least three ligatures will be necessary, the first being inserted at the verge of the anus, and the last at the base of the labia, through their substance. The hold should be very firm, otherwise there will be danger of premature separation.

Fig. 575.

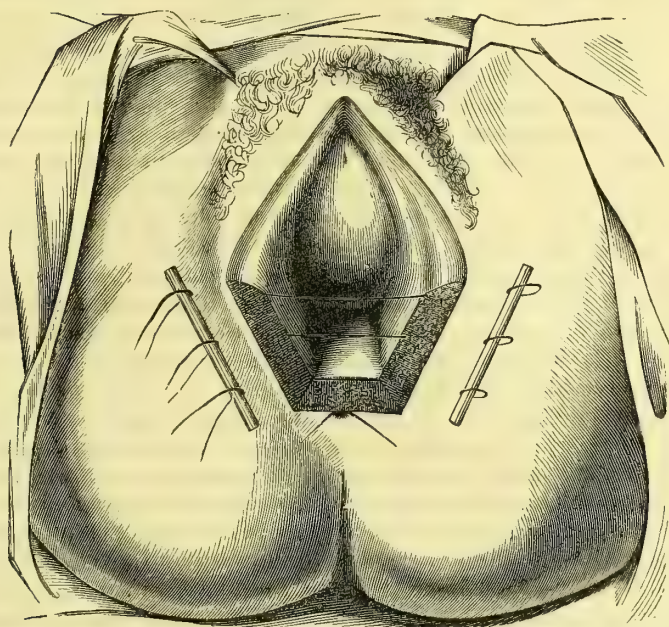


In performing this operation, the patient, brought fully under the influence of chloroform, is placed upon her back, in the same position as in the operation of lithotomy, the bowels having been thoroughly cleared out the night before. For sewing up the recto-vaginal septum the best instrument that I know of is the one represented at page 638, in the section on staphyloraphy. The ligatures for the perineal fissure are readily introduced with the aid of the instrument depicted in fig. 575. The eyelet should be large, so that the thread may be easily re-inserted above, after transfixion has been effected on the opposite side. The ends of the ligatures are then separated, and secured over two pieces of bougie, as seen in the adjoining sketch (fig. 576), borrowed from Mr. Brown. Should there be much tension, the operator may now divide the sphincter muscle of the anus, from an inch to an inch and a half exterior to this opening, the incision beginning about three lines in front of the coccyx, and extending some distance outwards and backwards, the gap being left to fill up by granulation. Such an expedient, however, will seldom be required; at all events, I have not myself been obliged to resort to it in any of my cases.

The operation being over, the patient is placed in bed, her knees lying upon a pillow, and being tied together, to prevent any strain upon the perineum. A grain of morphia is at once given, in order to relieve pain and lock up the bowels, which should not be moved, if possible, for at least ten or twelve days. The diet should be as concentrated as possible, and, if there be any evidence of debility, a due allowance of brandy should be afforded. For the first three or four days, the cold water-dressing is used, and a syringeful of cold water is occasionally thrown into the vagina. The sutures should not, on an average, be disturbed under a fortnight, or until there is reason to believe that the union is perfect. Strict recumbency should be maintained for at least a week longer.



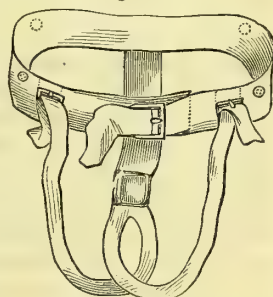
Fig. 576.



## PERINEAL BANDAGE.

Finally, it is necessary to add a few words respecting the perineal bandage, for retaining dressings upon the vulva, perineum, and anus, as well as for affording support in prolapse of the uterus and rectum. It consists, as the adjoining cut (fig. 577) sufficiently indicates, of two distinct pieces, a circular and a perpendicular; the former passing round the hips, and the latter over the perineum and vulva, where it is provided with a pad, covered with oiled silk. It is then split in two, each strip being brought up in front, and attached to the circular girth.

Fig. 577.



Perineal bandage.

## SECT. VIII.—AFFECTIONS OF THE MAMMARY GLAND.

The mamma is liable to inflammation, abscess, hypertrophy, neuralgia, and various kinds of tumors, both innocent and malignant. The latter, in fact, appear to have a sort of pre-emption right to this organ.

## MAMMITIS.

Inflammation of the breast, technically termed mammitis, is chiefly observed during lactation, in consequence of suppression of the cuta-

neous perspiration, or retention of the milk, causing over-distention of the lactiferous ducts. It may also arise from too free living, neglect of the bowels and secretions, and from the effects of external violence. It generally comes on within the first fortnight after parturition, beginning in the form of one or more ovoidal lobules, hard and tender to the touch, somewhat deep-seated, and not exceeding the volume of an almond. As the inflammation progresses, other lumps appear, and gradually coalescing, at length involve the whole breast, glandular structure and connective tissue as well. The organ is now exceedingly large, hard, and heavy, exquisitely painful, and intolerant both of manipulation and pressure. The skin is hot, discolored, tense, and glossy, pitting, perhaps, here and there slightly under the finger. The secretion of milk is either arrested, or, at all events, much diminished, and great difficulty is experienced in emptying the organ, the choked-up ducts being seemingly indisposed to part with their contents. Well-marked constitutional symptoms are always present at this stage of the disease. The patient is hot and feverish, or alternately hot and chilly, the tongue is dry and coated, the pulse is full and frequent, the bowels are constipated, and the urine is scanty, high-colored, and loaded with urates. If permitted to go on, the inflammation soon passes into suppuration, the event being announced by the ordinary local and constitutional phenomena, especially throbbing, an erysipelatous blush of the skin, and rigors alternating with flushes of heat.

The *treatment* of acute mammitis must be conducted upon strictly antiphlogistic principles, early and vigorously enforced. If the patient is very plethoric, blood is taken from the arm, or by leeches from the seat of the disease, the bowels are moved by active purgatives, vascular action is controlled by the antimonial and saline mixture in combination with aconite or veratrum, and the lightest possible diet is enjoined, with an avoidance of fluids of every description, thirst being allayed by the use of ice. The breast must be well supported with an appropriate bandage, and the surface must be kept constantly wet with warm water-dressing, medicated with acetate of lead and laudanum. If suppuration be threatened, an emollient poultice, if not too heavy, will generally be found to be very grateful. Pain is allayed by anodynes, conjoined with diaphoretics, especially if there be dryness of the skin. The breast should be relieved at least twice a day of milk, either by suction with the mouth or a suitable pump, the child receiving its nourishment from the sound organ.

A speedy check may often be put to an incipient mammitis by rubbing the affected organ thoroughly several times a day with warm oil and laudanum, or mild ammoniated liniment, the friction being made in the direction of the lactiferous ducts, that is, from above downwards towards the nipple, by the nurse, as she stands behind the patient, and supports the posterior surface of the breast with one of her hands. This mode of treatment, which is particularly insisted upon by Dr. S. C. Foster, of New York, generally exerts a powerful effect upon the indurated gland, softening it in a short time, reducing the swelling, and promoting the flow of milk.

New-born *infants* are subject to a peculiar intumescence of the breast, consisting in inflammation of the glandular structure of the organ and of the surrounding cellulo-adipose tissue, the nipple, which is usually a good deal enlarged, forming the centre of the swelling. The part feels excessively hard, and is exquisitely tender on pressure. Under an erroneous supposition that the disease is caused by an accumulation of milk, the breast is often rudely squeezed; a circumstance which never fails to aggravate the morbid action. If improperly managed, suppuration may occur, as I have witnessed in quite a number of cases. Both breasts are sometimes involved. The disease generally appears within the first fortnight; sometimes, indeed, within the first few days, or at so early a period as to induce the belief that it is congenital. As it advances, the part becomes excessively painful, and the child is feverish and restless.

The disease, in its incipient stages, generally readily yields under the use of sweet oil and laudanum with a little ammonia, applied quite warm, and rubbed in well frequently with the bare finger. In the intervals the surface should be constantly covered with a thick layer of flannel saturated with a solution of hydrochlorate of ammonia, in the proportion of one drachm to four ounces of water and two of vinegar. When the disease is obstinate, or already far advanced, a leech may be applied, followed by a teaspoonful of castor oil. In the event of suppuration, an early puncture is made.

#### ABSCESS.

When *mammitis* passes into suppuration, the matter always collects in the form of an abscess, which may be situated either in the interlobular substance of the gland, in the cellulo-adipose tissue beneath the skin, or in the connective substance behind the organ, the frequency of the occurrence being in the order here stated. The symptoms denotive of the event are, an increase of the pain, which is throbbing, deep-seated, and continued, a dusky or purplish appearance of the skin, a sense of fluctuation, especially if the matter has already accumulated in considerable quantity, and rigors, or chilly feelings, alternating with flushes of heat, and followed by copious sweats. When the pus is situated at an unusual depth, its presence is often indicated by an oedematous state of the subcutaneous cellular tissue.

The matter which is formed in this disease is generally of a thick, cream-like consistence, and of a whitish or pale yellowish color. When the inflammation has been very high it is apt to contain flakes of lymph and pure blood, the latter being usually in a state of coagulation. Milk is almost always a prominent ingredient. Even when it exists in so small a quantity as to be undiscoverable by the naked eye, its presence may, in general, be readily detected by the aid of the microscope. The quantity of pus varies from a few ounces to upwards of a quart, the average being from four to eight ounces. From a week to a fortnight is the time required by the abscess to work its way to the surface.

The *treatment* of mammary abscess consists in an early and free



incision, for the twofold purpose of relieving pain and saving structure. The edges of the wound are prevented from closing by the use of the tent. The most suitable application for the first few days will be an emollient poultice, or the warm water-dressing. All rude squeezing with a view of promoting the evacuation of the pus must be avoided, as it is calculated not only to produce pain, but also to aggravate inflammation.

When the treatment of mammary abscess has been neglected, or mismanaged, the matter is extremely apt to burrow, dissecting the lobules of the glands from each other, and also, in many cases, from the surrounding parts, thus causing extensive havoc, and the formation of numerous sinuses; sometimes as many, perhaps, as half a dozen. Such cases are always attended with great suffering, both local and constitutional. Until lately, the treatment used to be as cruel as it was generally tedious and unsatisfactory, the object being to trace out the passages with the director and knife, with a view, as was alleged, of healing them from the bottom, a tent being maintained in them for the purpose. Within the last few years a more scientific mode of management has been extensively pursued in this country, in consequence of the recommendation of Dr. Foster. It consists simply in the application of compressed sponge, confined by means of an appropriate bandage, aided by a suitable diet, and attention to the bowels. The sponge, freed of dirt, perfectly soft, elastic, and large enough to cover the entire breast, is thoroughly dried, and then effectually compressed by keeping it for twenty-four hours under a heavy weight, as, for example, a common letter copying press. Thus prepared, it is bound upon the affected organ over a piece of patent lint, to prevent irritation of the skin, by means of a roller passed several times around the chest, above and below the sound breast. It is then saturated with tepid water, which has the effect of expanding it towards the diseased structures, pressing the walls of the sinuses together, and at the same time forcing out their contents and absorbing them. The sponge is changed once in the twenty-four hours. A little pain generally attends the first application, but this usually disappears in fifteen or twenty minutes, and does not recur afterwards. The improvement under this treatment is most rapid, the worst cases generally recovering in a few weeks. If the general health is much impaired, it should be conjoined with the use of tonics, a nourishing diet, and exercise in the open air. The organ, after recovery, may be allowed to remain inactive, or suckling may be resumed, if it should be deemed necessary.

In my own practice, I have usually succeeded, without difficulty, in relieving such cases, by systematic compression with adhesive strips, or, what is better, with strips of gum ammoniac and mercurial plaster, applied quite firmly, and in such a manner as not to interfere with the discharges. I have often effected excellent cures, under such circumstances, simply by wrapping up the breast in the ammoniac and mercurial plaster, without cutting it into strips.

The *chronic abscess* of the breast is often a very troublesome and annoying affection, the more so because of the difficulty occasionally

experienced in the diagnosis. I have repeatedly had patients sent to me from a great distance under the supposition that they were laboring under malignant disease of the mamma, when their only ailment was a chronic abscess. What is still worse is that the organ has occasionally been extirpated in such cases, as I have myself known it to be in two instances. Such stupidity cannot be too severely reprehended, especially as there is not the slightest excuse for it, the use of the exploring needle always promptly revealing the true nature of the disease.

It is probable that the chronic mammary abscess is occasionally of a strumous nature, especially when it attacks, as I have known it to do in several instances, young, unmarried females; but, in general, it will be found to be the result of ordinary inflammation, occurring during suckling, and proceeding in a very slow and stealthy manner, in consequence of some defect in the constitution, or of some obstruction in the lactiferous ducts. In most cases, the disease takes place in the breast which the child has been unable to use on account of a sore or retracted nipple. Sometimes the exciting cause is a blow or contusion, perhaps so trivial as not to attract any attention at the moment.

The disease usually begins in the form of several hard lumps, which, gradually coalescing, at length unite into one solid mass, of irregular shape, and of firm consistence; sometimes involving only a portion of the breast, and at other times the entire organ. Occasionally the glandular structure escapes completely, the morbid action being confined exclusively to the cellular tissue around, behind, or in front of the breast. By and by, a process of softening begins, and steadily progressing, a large accumulation of pus occurs, pressing upon the parts in every direction, and fluctuating distinctly under the finger. Marked enlargement of the subcutaneous veins usually attends, especially when the disease is of long standing, but there is no discoloration of the skin, and seldom any severe pain; merely, perhaps, a sense of weight and of uneasiness. The general health is not materially affected, and there is no involvement of the surrounding lymphatic ganglions. The disease may last for months.

The *treatment* of chronic mammary abscess is by evacuation, and support of the breast by the gum ammoniac and mercurial plaster, aided by the bandage. Recovery will be promoted by attention to the diet and bowels, and by the use of tonics and alterants. The cure is generally perfect.

#### GANGRENE.

The mammary gland is astonishingly exempt from gangrene. Such an occurrence, indeed, is possible only in very unhealthy females, or in women who, in addition to scrofulous or syphilitic disease, have been suffering, at the time of the inflammatory seizure, under an impoverished state of the blood. A few cases are upon record where gangrene of this gland was occasioned, in middle-aged females, by the protracted use of ergot. In erysipelas and carbuncle the cellular tissue around the gland sometimes mortifies, the mamma itself generally escaping. The treatment of this affection, however induced, is to be conducted in

the same manner as in gangrene in other parts of the body, and, therefore, does not require any special notice.

#### SORE NIPPLES.

Women, during their confinement, particularly if it be a first one, are extremely liable to suffer from inflammation of the nipple, speedily terminating in ulceration. The sores have generally the appearance of superficial fissures, cracks or abrasions, attended with a thin, serous, or sero-sanguinolent discharge, and excessive pain, usually of an itching, smarting character. Occasionally the ulceration extends to a great depth, partially separating the nipple from the breast, and thus greatly augmenting the suffering. The affected parts are red and inflamed, the breast feels tender and hard from the accumulation of milk, and the sebaceous follicles around the nipple are irritated and sensibly enlarged. The disease usually appears within the first few days after delivery, in consequence of the application of the child's mouth, which never fails to aggravate it.

The *treatment* consists in the application of collodion, in thoroughly emptying the breast at least three times a day, with the pump, and in the use of an active purgative, along with a light, dry diet, the object being a partial suppression of the milk. If both nipples are affected, the child should be compelled to suck through the medium of a heifer's teat, until the parts are cicatrized. Meanwhile, as well as afterwards, they should be carefully protected from the pressure of the clothes, by means of an appropriate glass.

When collodion fails to afford relief, various astringent remedies may be employed, as weak solutions of alum, zinc, or copper, in union with tannin. Nitrate of silver, in the proportion of two grains to the ounce of water, sometimes answers a good purpose. Yellow wash, prepared with one-fourth of a grain of the salt to the ounce of water, makes an excellent application for superficial chaps of the nipple, but caution must be observed in its use. Occasionally nothing affords such prompt relief as the ointment of the nitrate of mercury, diluted with six or eight times its weight of lard. A strong solution of borax, thickened with brown sugar, and rendered stimulating with brandy, is a favorite domestic remedy, from which I have frequently derived great benefit.

In most cases, the foundation of this disease is laid during pregnancy, from a want of proper attention to the parts. In general, all difficulty may be successfully prevented by the avoidance of pressure, and the use of some astringent wash, as alum and tannin, for the purpose of hardening the nipples. When these structures are unusually small, means should be employed to elongate them with the pump, to qualify them for their approaching duties.

#### NEURALGIA.

Neuralgia of the breast may occur at any period after puberty, but is most common in young females from the age of fifteen to thirty. It



is characterized by exquisite pain, darting through the part like electricity, and extending generally to the corresponding shoulder and axilla, and sometimes down the elbow to the fingers. The suffering, which resembles that of *tic-douloureux*, and which often observes a regular periodicity, is very much increased prior to menstruation, and is sometimes so severe that the patient is unable to lie upon the affected side, or bear the weight of the bedclothes. The disease may last for years, and is met with mostly in persons of a nervous, irritable temperament, with deficient menstrual secretion.

The morbid action is commonly confined to several of the mammary lobules, which either retain their natural bulk and appearance, or, what is more common, they are converted into small, solid tumors, distinctly circumscribed, movable, and highly sensitive to the touch. Occasionally these swellings seem to be seated in the connecting cellular tissue rather than in the glandular structure; they seldom exceed the size of a marble, an almond, or a walnut; they never supurate, and they sometimes disappear spontaneously.

More or less disorder of the general health usually attends this affection; the patient looks pale and thin, is remarkably susceptible to atmospheric impressions, and nearly always suffers under marked derangement of the menstrual function, the discharge being unusually scanty, and attended with a great deal of pain. In most of the cases that have fallen under my observation, the disease was associated with neuralgia in other parts of the body.

The *treatment* is to be conducted upon ordinary anti-neuralgic principles. The general health having been amended by a proper regulation of the diet and the use of purgatives, the patient is placed under the influence of quinine, or, if there be evidence of anemia, quinine and iron, in union with arsenic, strychnia, and aconite, cannabis Indica, or stramonium, steadily and persistently continued, with an occasional intermission, until a decided impression has been made upon the complaint. Sometimes the exhibition of colchicum and morphia proves highly beneficial; and I have seen cases in which nothing appeared to answer so well as the antimonial and saline mixture, with aconite. The most suitable local remedies are anodyne liniments and plasters, preceded, if there be considerable tenderness and swelling, by leeching. The breast must be well supported and protected from pressure. The menstrual function must receive due attention.

#### HYPERTROPHY.

Hypertrophy of the mamma is not uncommon, nor is it, as might be supposed, confined entirely to the female sex. I have repeatedly seen both breasts of the male enlarged many times beyond their normal bulk, and not a few cases are recorded where they have freely, and, for a long time, secreted milk. In women, the swelling is commonly associated with amenorrhœa; but it sometimes occurs during pregnancy, and disappears soon after delivery. Occasionally the affection begins at an early period of life, and goes on progressively increasing until the breast acquires an enormous bulk. Of this, an

interesting case came under my observation in 1857, in a colored girl, nearly seventeen years of age, a patient of Dr. Hanly, of this city. The hypertrophy involved both organs, but not in an equal degree, the right being more than twice the volume of the left, and weighing, by estimate, upwards of fifteen pounds, its length exceeding fifteen inches. They were of a very firm consistence, considerably nodulated, and quite tender on manipulation. The subcutaneous veins were enormously enlarged. The hypertrophy had commenced without any assignable cause, when the girl was twelve years of age. When I first saw her, she had been confined a fortnight, and I was informed that her breasts had much increased in size both during and since her pregnancy. Her general health had become much impaired, and she was excessively emaciated. Dorsten gives a case of this kind, in which the left breast weighed sixty-four pounds.

The true nature of this disease is not determined. In some cases the affected organ retains its normal structure, at least apparently so; whereas in others it is materially altered, being preternaturally dense and firm, and deprived of its glandular character. The interlobular cellular tissue is much augmented in quantity, and similar changes are generally witnessed in the cellulo-fatty substance surrounding the organ. Occasionally the enlargement is associated with retention of the milk.

The *treatment* of mammary hypertrophy is generally conducted upon empirical principles. The use of sorbefacients would necessarily suggest itself in such a disease, but it does not appear that it has hitherto been of any marked benefit. The most suitable article would be iodine, administered internally, and applied to the affected organ, either in the form of tincture or of ointment. Gentle and protracted ptyalism might be serviceable. Occasionally benefit has accrued from the steady and persistent exhibition of the hydrochlorate of ammonia, in doses of from ten to twenty grains, thrice a day. Whatever remedies be employed, special attention should be paid to the improvement of the general health, which is often much impaired. The breast should be well supported, to take off weight and tension. Strapping the organ carefully with ammoniac and mercurial plaster would probably exert a more powerful sorbefacient influence than any other local means, though I am not aware that it has ever been fairly tested. Extirpation should be resorted to when the tumor, refusing to yield to treatment, is so large as to cause severe suffering and inconvenience, gradually, but effectually, undermining the general health.

#### ATROPHY.

Atrophy of the mamma is a natural effect of old age. When the menstrual function ceases, the gland begins to diminish in volume, and the wasting gradually progresses, until, at length, the whole organ is reduced to a soft, flabby mass, of a dirty, grayish tint, in which it is often difficult to detect any of the natural structure, except the lactiferous ducts, which are seldom completely effaced. Sometimes the gland shrinks early in life, particularly in married females who do not nurse their offspring. Atrophy of this viscus occasionally results from

the effects of neuralgia, and the use of certain medicines, as iodine and hemlock.

This lesion presents little of surgical interest. When it occurs in young females, as a consequence of the use of medicines, neuralgia, or habitual pressure, immediate measures should be adopted for its arrest, otherwise the organ may be irretrievably lost.

#### FISTULE.

During lactation, a galactophorous duct is sometimes included in a wound of the breast, and, unless the edges of the integuments be very closely approximated, a lacteal fistule may remain. The same consequences may be produced by a rupture of the canal from the inordinate accumulation of milk. A more common occurrence is the formation of accidental outlets, from the irritation of multilocular abscesses. These passages are often of considerable depth, tortuous, numerous, lined by an adventitious membrane, and attended with a great deal of induration of the surrounding parts.

The disease will usually disappear of its own accord, as soon as lactation is over, and frequently even long before that event. If the case be troublesome, a cure should be attempted by the application of compressed sponge, aided, if necessary, by stimulating injections.

#### CALCAREOUS CONCRETIONS.

Calcareous concretions are met with in the breast, either in its substance or in the lactiferous ducts; they are commonly small, not exceeding an ordinary pea, and are observed chiefly in connection with fibrous and other tumors. I have seen these bodies only in two instances, in females far advanced in life. They were of a whitish color, irregularly spherical in shape, and of a hard, solid consistence, like dry mortar. A case has been described by Berard, in which the outer portion of the mamma was converted into a complete osseous shell.

Unless these concretions prove a source of inconvenience or annoyance, they should be let alone, especially if the patient has not passed the child-bearing period, as an operation might be attended with serious injury to the lactiferous tubes.

#### APOPLEXY.

The breast is liable to apoplexy, consisting in an effusion of blood into the connecting cellular tissue, resembling an ecchymosis produced by a blow or leech-bite. Generally there is only one such spot, but there may be several, coming on a few days before the menstrual period, and disappearing within the first week or two after; though sometimes they continue for more than a month. The disease seems to depend upon some sympathetic action between the uterus and the breast, causing a great determination of blood to the latter, eventuating in the rupture of some of its smaller vessels. The affected parts are always of a dark, livid hue, and are exquisitely tender on pressure, the pain sometimes shooting down to the ends of the fingers.

The *treatment* of this affection consists in sorbefacient applications,



especially if some time has elapsed since its occurrence. When the effusion is recent, it will generally promptly disappear under cold saturnine and opiate lotions.

#### BENIGN TUMORS.

Under this head may be included various kinds of growths of a benign, or non-malignant character, as the sero-cystic, hydatid, lacteal, and adenoid.

##### 1. SERO-CYSTIC TUMORS.

Tumors of the breast, containing serous cysts, are sometimes met with; chiefly in married females between the twentieth and fortieth year. The disease, constituting what was formerly called cystic sarcoma, is strictly of a benign character, and is never reproduced after removal. Its progress is always very tardy, and is seldom attended with any decided disorder of the general health, the chief inconvenience caused by the morbid growth arising from its weight and bulk, which is sometimes enormous. How the affection originates is unknown. It usually begins in the interlobular cellular tissue of the gland, which, as the disease advances, is completely annihilated.

Two distinct forms of cystic disease of the breast are met with, the unilocular, and the multilocular. In the former, the cyst, as the name implies, is single, and composed of a membrane which bears a very close resemblance to the peritoneum, its inner surface being perfectly smooth and glossy, while the outer is intimately connected to the surrounding parts by short, cellulo-fibrous tissue. Occasionally the cyst is intersected by membranous bands, separating it into a number of distinct compartments, of varying size and shape. When this is the case, the cyst is said to be *multilocular*. Various fluids are found in these sacs. Generally they are of a serous nature, more or less viscid, coagulable, of a saline taste, and of a limpid, or pale yellowish appearance; but cases occur in which they are of a reddish, olive, brownish, claret, or blackish hue. Not long ago I saw an instance in which the fluid was of the color of the tincture of iodine. Sometimes, again, it is of a lactescent nature, whey-like, or muco-albuminous. Finally, there are cases, although they are rare, in which the fluid contains cholesterine, flakes of lymph, and other substances.

Cysts of the character now described often attain a large bulk, being capable of holding from twenty to sixty ounces of fluid.

Very frequently, again, the cysts are *multiple*, their number, perhaps, ranging from a few dozens to many hundred. When this is the case, they are generally very small, their volume varying from that of a hemp-seed to that of a pigeon's egg. Their shape is usually spherical, ovoidal, or conical. When young, they are smooth, transparent, elastic, vascular, closely adherent, and filled with a clear, watery fluid, slightly saline in its taste, and scarcely coagulable by heat, alcohol, or acid. Their parietes, however, are liable to become opaque and thickened, from the effects of inflammation, and the same cause generally induces remarkable changes in the contained fluid, which may be lactescent, bloody, oleaginous, glairy, or gelatinous. Different cells of the same tumor

often have dissimilar contents. The morbid mass is sometimes entirely composed of cysts; at other times a considerable proportion of solid matter is interposed between them, commonly of a tough, cellulo-fibrous nature. The characters of the multiple form of this disease are well seen in fig. 578, from a preparation in my cabinet.

The *diagnosis* of this malady is often obscure, especially in its earlier stages. The chief signs of distinction are, the gradual and steady growth of the tumor, the absence of pain and of lymphatic involvement, a sense of fluctuation, more distinct at some points than at others, the natural appearance of the integuments, and the retention of the general health. When any doubt exists, it will usually be promptly dispelled by a resort to the exploring needle.

When the tumor is large and of long standing, it sometimes manifests a disposition to ulcerate, but, in general, as it goes on increasing, the skin gradually accommodates itself to its size.

The only reliable *remedy* for this disease is free excision, including, if the tumor is unusually bulky, an elliptical portion of integument. If the cyst is unilocular, and not very large, a cure may generally be effected with the seton, or the injection of iodine. Or, instead of these, the sac may be laid open, and irritated with a tent. When the cyst is very capacious, nothing short of excision will answer, and there is the more reason for its performance when there is a probability that the tumor has completely annihilated the glandular structure of the organ.

## 2. HYDATIC TUMORS.

Hydatids seldom infest this gland, at least in the females of this country. In the examination of a great number of breasts, I have not met with more than two cases. They always belong to the class of echinococci, and are most common between the ages of twenty-five and fifty. Varying in volume between a currant and an orange, they may occur in any portion of the organ, the proper substance of which they generally completely destroy. They are of a globular figure, and present themselves either in clusters, or as bodies perfectly distinct from each other. When of considerable size, it is not uncommon to find within the old hydatids young ones, hanging by narrow footstalks, and having precisely a similar configuration and structure. The contained fluid is generally thin and limpid, but it may be thick and glairy, like the white of egg. In the older hydatids, especially such as are partially dead, there is sometimes an admixture of blood, pus, albumen, or curdy matter. These bodies may exist either alone, or in connection

Fig. 578.



Cystic disease of the breast.

with other morbid products; and, when large and numerous, are productive of extraordinary enlargement of the breast, cases now and then occurring where the organ weighs from eight to ten pounds.

As in the cystic tumor, so in this the *diagnosis* is often very difficult, if not impossible. In its earlier stages, the disease is liable to be confounded with scirrhus; afterwards, when it has attained a large bulk, with encephaloid. The most important signs are, the tardy progress of the case, the unimpaired state of the general health, the absence of lymphatic involvement, the natural appearance of the skin, and the globular or ovoidal shape of the tumor, together with its large size and want of adhesion to the surrounding structures. The pain is usually much greater than in mere cystic disease, although there is sometimes none at all, and there is but little fluctuation, except when the tumor has acquired a large bulk, when it is always well marked. There is nothing, however, of a truly diagnostic character in any case, except the escape of some of the contents of the tumor.

The only remedy for the hydatid tumor is thorough excision, performed as soon as possible after the establishment of the diagnosis. The operation is never followed by relapse.

### 3. LACTEAL TUMORS.

The breast, in consequence of the occlusion of some of its lactiferous ducts, is liable to an inordinate accumulation of milk, forming a distinct swelling, known as the milk tumor. It is generally of a globular or ovoidal shape, and is capable of acquiring a large bulk, as is evident from some of the reported cases. Thus, in one related by Professor Willard Parker, in a woman, aged thirty-five, three quarts of fluid were evacuated at the first operation, and half that quantity in a week afterwards. In an instance recorded by Scarpa, the breast measured thirty-four inches in circumference, and gave vent, on being punctured, to upwards of a gallon of pure milk. It has been supposed that the sac in which the fluid is contained, is formed by the dilatation of the lactiferous tubes; but, considering the rapid development of the tumor, and the enormous volume which it occasionally attains, the more plausible conjecture is that the milk is poured out into the connecting cellular tissue of the gland, which is thus gradually condensed into a sort of cyst. The swelling usually begins within the first month after delivery, and often attains a large bulk in a few weeks. It is attended with a peculiar sense of distention, without any decided pain, and distinctly fluctuates under the finger. On cutting into it, the contents are found to be of a whitish color, and of the consistence of milk, cream, or whey. The general health is unimpaired. When the tumor is unusually voluminous, there is always marked enlargement of the subcutaneous veins.

There is a form of milk tumor of the breast, in which the contents are of a solid character, bearing a close resemblance to butter, and hence called the *butyroid* tumor. It consists of a cyst, inclosing a yellowish, concrete substance, of the appearance of butter, cheese, or casein. Microscopical and chemical examinations render it highly probable that this formation takes its rise in a deposition of milk,



consequent upon the rupture of a lactiferous duct, the more fluid portions being absorbed, while the solid are retained, and thus gradually assume the properties here assigned to them. The disease is very uncommon, and the diagnosis must necessarily be very obscure.

The *treatment* of the milk tumor should be conducted upon the same principle as that of any other encysted formation; that is, either by the injection of some stimulating fluid, as the dilute tincture of iodine, the seton, or the tent, care being taken that the resulting inflammation does not run too high. When the tumor is solid, the proper operation, of course, is excision.

#### 4. ADENOID TUMORS.

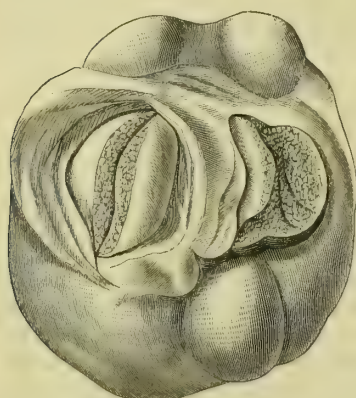
The breast is liable to a species of fibrous transformation, not unlike that which we occasionally see in the testicle. It is principally observed in young females, either single, or married and without offspring. The tumor, which is slow in its formation, is free from malignancy, and is seldom attended with any marked disorder of the general health. The breast feels hard, usually somewhat unequally so, and often acquires a considerable bulk, producing perhaps, ultimately, considerable inconvenience by its weight. The subcutaneous veins become gradually enlarged, but there is hardly any pain, and no involvement of the neighboring lymphatic ganglions. The nipple is generally natural. The disease usually arises without any assignable cause.

The intimate structure of this tumor consists of a pale grayish, pink, or bluish substance, nearly homogeneous, friable, easily crushed, and very similar to that of a hypertrophied lymphatic ganglion. Hence, the term adenoid, now generally applied to this form of mammary tumor. Some parts of it may be so hard as to creak under the knife, and specimens occur which possess all the properties of old fibrinous concretions. Minute cells, variable in size and number, are occasionally scattered through it. Generally the tumor is inclosed by a distinct capsule of condensed cellular tissue. The probability is that the transformation commences in the interlobular substance of the organ, and that new fibrous tissue is superadded, which, by its pressure, causes at first atrophy, and finally total destruction of the primitive glandular texture.

The adenoid mamma is occasionally filled with small nodules, of a rounded form, from the size of a filbert to that of a common hickory-nut, hard, almost inelastic, movable, inclosed in cysts, and perfectly distinct from each other, the intervals between them being occupied by fibrous substance. In a specimen in my cabinet, removed from a married, but sterile female, aged thirty-three, each breast contains at least a dozen of such masses. The disease had been in progress for upwards of three years, and was attended with considerable enlargement of each gland, but there was an entire freedom from pain, lymphatic involvement, and disorder of the general health. The organs were perfectly movable, and numerous nodules could be felt in their substance in every direction. The nipples were badly developed, but not more retracted than we often see them in women who have never borne children.

Upon making a careful examination of the little bodies above described, I found that they all consisted of a kind of cyst, inclosing a mass bearing a striking resemblance to a cauliflower, being composed of a fibrous membrane, of a white, glistening appearance, thin, and semi-transparent, folded like the ruffle of a shirt, and studded with an

Fig. 579.



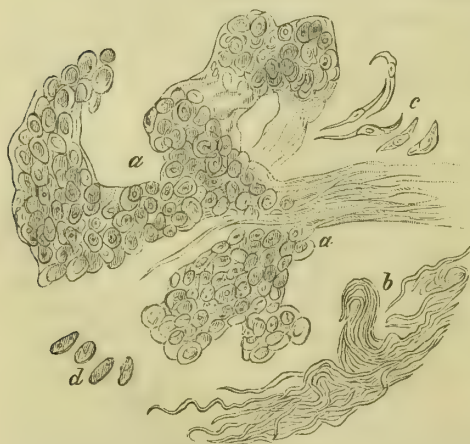
Adenoid tumor of the mamma, exhibiting its cystiform arrangement and internal structure.

immense number of small, delicate excrescences, looking very much like the warts which are so often met with upon the penis. They all adhered by a broad base or stem, and were made up each of a number of minute granules, resembling the eggs of certain insects. Under the microscope, Dr. Da Costa and myself found the stems to consist of fibrous tissue, while the granules were composed, for the most part, of rounded bodies, presenting a delicate, fibrillated stroma, inclosing small, ovoidal and spindle-shaped cells in varying proportion. The hard part of the mamma, that in which the nodules were developed, consisted of bundles of very dense fibrous tissue, wavy, and extremely distinct. Fat-cells were here and there embraced in

its meshes. The adjoining cut (fig. 579) represents, though very imperfectly, the internal structure of these nodules.

The only *remedy* for this tumor is excision, but such a measure will only be required in the event of the morbid growth being very large, painful, or inconvenient by its weight. Sorbefacient applications, and the exhibition of iodine, are usually of no benefit. Compression might be tried in the early stages of the disease.

Fig. 580.



Fibrous mammary tumor. *a.* Gland tube, containing nucleated cells. *b.* Fibrous tissue. *c.* Fibro-plastic cells. *d.* Free nuclei. 472 diameters.

The microscopic features of the ordinary fibrous tumor of the mammary gland are well exhibited in the accompanying drawing (fig. 580), by Dr. Packard, from one of my clinical cases, a woman, aged forty-three. A section of the growth, treated with acetic acid, revealed 1st, portions of lactiferous tubes, some lined with epithelium, and others showing merely a basement-membrane; 2d, fibrous tissue; and, 3d, fibro-

plastic cells, in small numbers. The tumor, about the volume of a large fist, had commenced seven years previously, and had latterly been the seat of sharp, shooting pains. There was no retraction of the nipple, lymphatic involvement, enlargement of the subcutaneous veins, or serious disorder of the general health.

#### MALIGNANT TUMORS.

The most common malignant diseases of the mamma are scirrhus and encephaloid. Melanosis and colloid are extremely infrequent.

##### 1. SCIRRHUS.

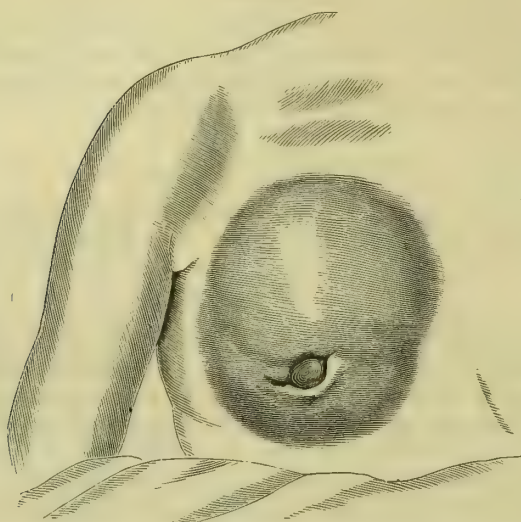
Scirrhus of the breast is most common soon after the decline of the menses, in married females, the greatest number of cases occurring between the ages of forty-five and fifty-five. It is extremely rare to meet with an instance before the fortieth year. Old maids occasionally suffer from it, but much less frequently, relatively speaking, than women who have borne children. Its origin is generally spontaneous, although it is often referred by the patient to the effects of a blow or some other external violence. It has been known to happen in four or five members of the same family, and occasionally it co-exists with scirrhus in other parts of the body. An instance now and then occurs in the male. It usually begins insidiously as a small, circumscribed lump, hard and irregular to the touch, and somewhat tender on pressure. As the disease progresses, the whole gland becomes involved, assuming a firm and knobby character, movable, and the seat of occasional pain, of a sharp, lancinating, darting nature. Advancing still farther, the tumor gradually contracts adhesions to the surrounding parts, especially to the pectoral muscle, so that eventually it can no longer be lifted up, or pushed about. In the mean time the nipple is retracted; the skin is puckered and discolored; the superficial veins enlarge, and assume a deep bluish tinge; and presently ulceration sets in, leaving one or more circular sores, with hard, depressed, angry-looking edges, and a foul, sloughy base. The discharge is thin, ichorous, offensive, and often so acrid as to corrode the healthy skin. Gradually the irritation extends to the neighboring lymphatic ganglions, which either become white, firm, and tumid, or they are rendered preternaturally soft and vascular, having often a bloodshot appearance.

The retracted appearance of the nipple is well shown in fig. 581, from a patient at the College clinic. It often begins early in the disease, and is produced by the manner in which the lactiferous tubes are compressed by the scirrhus matter.

Although scirrhus generally commences in the glandular structure of the mamma, yet occasionally its primitive seat is in the common integuments and in the surrounding cellulo-adipose tissue. In the former case it usually presents itself in the form of a small, rounded tubercle, scarcely larger than a shot, of a bluish color, firm, superficial, movable, and free from pain. This gradually increasing, finally involves the glandular structure, the skin, meantime, becoming hard, discolored, and intimately adherent to the subjacent parts. In the



Fig. 581.

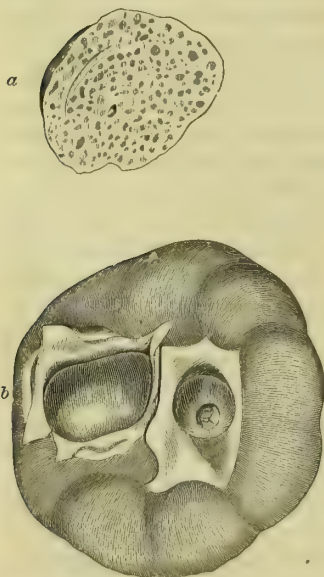


Scirrhus of the mamma, showing the characteristic retraction of the nipple.

other variety of the disease, a firm, oblong, or spherical lump, of considerable volume, is from the first felt deeply embedded in the adipose tissue around the organ, with which it has apparently as yet no connection. It may readily be lifted away with the thumb and finger,

but it soon contracts adhesions, gradually contaminates the adjacent structures, slowly approaches the surface, and at last breaks out into a foul, irritable, fungous ulcer.

Fig. 582.

*a.* Section of a scirrhus nodule.*b.* Scirrhus mamma laid open to show its lobulated structure.

On dissection, the mamma is found to be inelastic, firm, dense, and crisp, like cartilage, which it also resembles in color: sometimes it is of a dry, fibrous texture, like the interior of an unripe pear, and of a light grayish tint, interspersed with yellowish lines, probably the remains of lactiferous ducts; more rarely the organ is soft and succulent, presenting a considerable number of small vessels, and yielding, upon pressure, a thin, opaque, serous fluid, occasionally blended with milk. These appearances frequently occur together, forming so many zones, gradually and insensibly running into each other. In some instances, again, the tumor contains one or more cavities, filled with purulent matter, or with a viscid, ropy fluid, not unlike the synovia of the joints.

The malady, as already stated, usually commences in a few lobules; but, as it progresses, the whole organ becomes converted into a firm, solid mass, with a rough, tuberculated surface. In the annexed sketch (fig. 582), taken from a specimen in my cabinet, a large number of nodules are seen, the largest of which, hard and crisp, like cartilage, and of an oblong, spherical shape, scarcely equal the size of a pullet's egg.

Scirrhus of the breast sometimes remains stationary for a considerable length of time, when, taking a fresh start, it rapidly assumes the characters above assigned to it. When removed, it is almost certain eventually to return, either at the cicatrice, or in the contiguous lymphatic ganglions. The tumor is sometimes invaded by gangrene, even before ulceration has commenced. In a case of this kind, which came under my observation a few years ago, and which is described in the chapter on scirrhus, the morbid growth was lifted completely out of its bed, the cavity being afterwards filled up with healthy granulations, though the disease returned subsequently in the neighborhood of the original affection.

The *symptoms* of scirrhus of the breast are usually characteristic. Its lump-like origin in the body of the organ, the slow, but steady progress, the great hardness and comparatively small volume of the tumor, the sharp, lancinating pain, the retraction of the nipple, the gradual adhesion of the gland to the surrounding structures, and the ultimate involvement of the neighboring lymphatic ganglions, as those of the axilla and subclavicular region, are phenomena which it is impossible to misinterpret. The nature of the scirrhous ulcer is also peculiar. It has an excavated appearance, as if a portion of the tumor had been punched out, with a foul bottom, and steep, everted edges. The discharge is thin, sanious, fetid, irritating, and more or less abundant. Hemorrhage sometimes occurs, but seldom to any extent. Retraction of the nipple generally exists in a marked degree, and often begins at an early period of the complaint. Enlargement of the lymphatic ganglions, which seldom shows itself before the end of the ninth or tenth month, is generally very conspicuous after ulceration, especially in the axilla. In the more severe forms of the disease, it generally affects those also of the subclavicular region and even those of the neck. Swelling, pain, and numbness of the corresponding extremity always attend the malady in its latter stages, and greatly augment the suffering, the limb becoming perfectly stiff and useless, and feeling like a mass of lead.

The annexed drawing (fig. 583), taken from a clinical case, exhibits the condition of the scirrhous breast in the advanced stage of the disease, after the occurrence of ulceration. The tumor was of unusual volume.

The *general health* is variously affected. In most cases it remains comparatively good until ulceration begins, when it usually rapidly declines, the body becoming emaciated, and the countenance exhibiting that peculiar sallow, cadaverous appearance, so denotive of the cancerous cachexia. The pain, in the latter stages of the disease, is generally atrocious, depriving the patient both of appetite and sleep.

Fig. 583.



The *duration* of the disease is far from being uniform. Left to itself, it generally terminates fatally at a period varying from eighteen months to two years and a half. Occasionally death happens much sooner; and, on the other hand, instances occur in which it does not destroy life under ten, fifteen, or even twenty years, although such an event is extremely uncommon. When ulceration has once fairly begun, the health is rapidly undermined, and death usually follows in a few months.

During the progress of this disease *secondary* scirrhus growths sometimes appear; generally in the skin and cellular tissue of the breast, or in the parts immediately around, in the form of tubercles varying from the volume of a small shot to that of a pea, exceedingly firm and solid, slightly movable, very tender on pressure, and the seat of sharp, pungent pain. They often exist in large numbers. Thus, in one case I counted upwards of thirty. Occasionally they occur both over the mammary gland and at some distance from it. In a case recently under my care, in a female upwards of fifty, whose breast had been the seat of an enormous scirrhus tumor, of nearly two years' standing, tubercles of this kind appeared a few weeks before death upon the corresponding side of the trunk near the spine, shoulder, neck, and head, and also upon the upper part of the opposite arm. As these secondary growths increase in size, they project beyond the skin, and exhibit a red, vascular, angry appearance.

## 2. ENCEPHALOID.

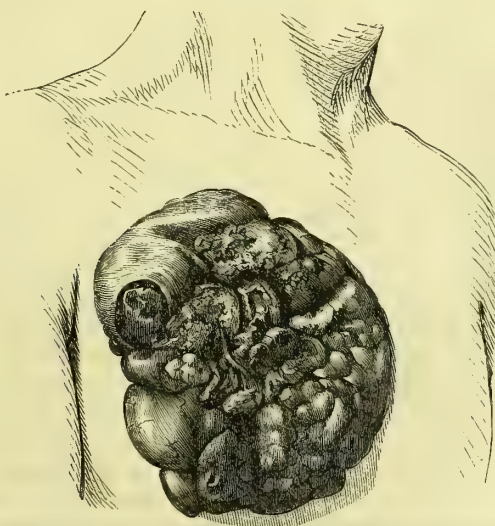
In comparison with scirrhus, encephaloid of the mamma is an extremely rare disease. No reliable statistics have been published respecting the favorite period of its attack, but, judging from my own observations, I am inclined to believe that it is most common in elderly subjects. I have met with it, however, repeatedly before the age of thirty-five, and in one instance in a girl of fifteen. Of its relative frequency to encephaloid in other organs, it may be stated that of one hundred cases of the disease analyzed for me by Dr. Cassot, only six occurred in the breast, the eye being affected in ten, and the scrotum and testicle in fourteen.

Encephaloid of the mamma usually *begins*, without any assignable cause, as a small tumor in the substance of the gland, which generally increases with frightful rapidity, often acquiring the bulk of a large fist or even of a foetal head in the course of a few months. Like



scirrhus, it is at first movable, but eventually it is firmly united to the surrounding structures, which it is sure, in time, to involve and contaminate. The pectoral muscle, in particular, is liable to suffer in this manner. The lymphatic ganglions, however, generally escape longer, comparatively speaking, than in hard cancer, and I have seen several cases in which, although there was extensive ulceration, they were entirely free from disease. Moreover, the subclavicular and cervical ganglions are less liable to suffer than in scirrhus. The tumor is usually knobby or tuberculated, and of varying degrees of consistence, being firm and incompressible at one point, soft at another, and perhaps fluctuating at a third. There is seldom any marked retraction of the nipple, even in the advanced stages of the malady. The subcutaneous veins are always greatly enlarged; the pain is comparatively slight; and the parts are generally singularly tolerant of manipulation. Ulceration sets in at variable periods; rarely before the ninth month or later than the twelfth. The resulting sore is peculiar. Its character is essentially that of a fungus, projecting beyond the surrounding level, soft, red, and the seat of more or less bleeding, and of a constant sanious, or thin, fetid, and sanguinolent discharge. The edges of the ulcer are sharp and undermined, and often drawn tightly over the protruding mass. Like the scirrhus ulcer, the encephaloid is intractable; its tendency is to spread, not to heal, neither having the power of forming healthy granulations. The external characters of the fungating and bleeding stage of the disease are well shown in the adjoining sketch (fig. 584).

Fig. 584.



Fungus hematodes of the mamma, in its open bleeding state.

The general *health* in encephaloid usually suffers at an early period; the patient loses flesh and strength, and the countenance exhibits a sallow, withered appearance, denotive of the profound impression which the disease is making upon the system. The pulse is small,

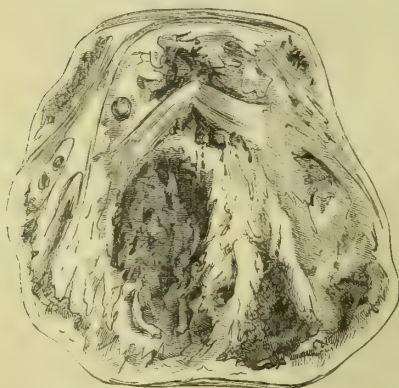
frequent, and irritable, the appetite fails, sleep is interrupted by the pain and the discharges, night-sweats set in, and thus the case steadily progresses, from bad to worse, until life is worn out by exhaustion. Sometimes the immediate cause of death is hemorrhage. The period at which this occurs varies, on an average, from about six to twelve months.

The *characters* of encephaloid are, in general, too well marked to admit of mistake, especially if the disease has taken a fair start. The great size, rapid growth, and comparative softness of the tumor, the healthy condition of the nipple, the enormous enlargement of the subcutaneous veins, the absence for a long time of severe pain, and the early constitutional involvement, will always serve to distinguish it from every other disease of the mammary gland. When, however, any doubt exists as to the diagnosis, as there may when the tumor has been developed with extraordinary rapidity, or when it presents well-marked evidence of fluctuation, the exploring needle may be used; of course, with great caution. After ulceration has begun, error is impossible.

The *anatomical* characters of encephaloid of the breast do not differ from those of soft cancer in other organs of the body. The structure of the tumor is seldom uniform, either as it respects its consistence, color, or composition. Thus, on making a section of it, one portion may perhaps be of a fibro-cartilaginous character, another pulpy and brain-like, and a third probably hematoid, or cystiform. Cavities or cells, containing different kinds of fluids, are often interspersed through it. Large clots of blood, sometimes of a black, brownish, or yellowish-

buff color, and of varying degrees of consistence, are also sometimes met with. The tumor has no capsule, except what is derived from the surrounding cellular tissue, which is occasionally considerably condensed; its surface is rough and lobulated; and its substance is usually pervaded by numerous vessels, many of them of large size. Hence the rapidity of its growth, its large bulk, and the frequent and exhausting hemorrhages after ulceration has commenced. It sometimes coexists with encephaloid or scirrhus in other organs. Fig. 585 affords a good idea of the hematoid form of encephaloid of the mamma.

Fig. 585.



Encephaloid of the mammary gland, of the hematoid variety.

The tumor from which the drawing was taken was removed from a negress, thirty years old, and was of very large size.

### 3. COLLOID AND MELANOSIS.

*Colloid*, alveolar, or gelatiniform cancer rarely attacks the breast. The tumor advances slowly, and seldom exceeds the volume of the

fist or of a foetal head. Externally, it is of a light grayish color, dense, firm, glistening, and irregularly lobulated; internally, it is comparatively soft and succulent, yielding some moisture on pressure, and tearing into hard, jelly-like strings. The cellular arrangement, so well marked in alveolar cancer of the stomach, is seldom very distinct in that of the breast.

*Melanosis* of the breast occurs either as an infiltration amongst the granules of the gland, or, as is most frequently the case, in the form of small, spherical nodules, of a black, sooty color. Of this disease, I saw an interesting specimen, some years ago, in an old female who died of pulmonary phthisis, accompanied with scirrhus of the left mamma. The little tumors, five in number, were distinctly encysted, and contained a thin, ropy fluid, of the color and consistence of China ink.

*Treatment.*—The treatment of malignant diseases, in general, has been so fully discussed in the first volume, as to render it altogether superfluous to say anything of a formal character respecting that of the malignant diseases of the breast. The great aim, in every case, whatever may be the nature of the malady, should be to maintain the health as nearly as possible at the normal standard, by a proper regulation of the diet, bowels, and secretions, with a careful suspension of the affected organ, and an avoidance of pressure by the dress. Pain and tenderness should be relieved in the usual manner. All ideas of specifics must be discarded. The case must be managed upon general principles, precisely as the most common disease. Leeches often prove useful when there is inordinate vascular turgescence; and under such circumstances, also, much benefit often results from astringent lotions. Anodyne plasters are frequently extremely soothing. Systematic compression, formerly so much vaunted, has been proved to be utterly useless. When ulceration takes place, the leading indications are, to moderate discharge, mitigate pain, promote cleanliness, and sustain the strength.

In regard to interference with the knife, nothing could be more unpromising. Although I have removed the breast in numerous cases, I have never, in a solitary one, succeeded in effecting a permanent cure; and such is precisely the result of the experience of the profession generally. If, as is alleged, a radical cure occasionally follows the use of the knife, the circumstance is to be ascribed either to good luck, or, what is more probable, to the fact that the disease for which the operation is performed was not of a malignant, but simply of an ordinary character. It has been asserted that, although malignant affections of the breast cannot be cured by ablation of the affected organ, yet that it has the effect of prolonging life, on an average, from six to eighteen months. This may be possible, but if it be, the fact remains to be established by reliable statistics, founded upon well observed cases after excision. In many cases, as every one knows, the patient is lost sight of as soon as the parts have recovered from the immediate effects of the operation, and in many more the history is obtained only very imperfectly. I have not known more than three or four instances where the woman lived longer than six or eight months without relapse, or an outbreak of the disease somewhere. Others



may have been more fortunate, but this is strictly what I have myself seen, in cases unequivocally cancerous. When the tumor occurs late in life, and is of tardy development, the chances are that the patient will get on better after excision than under opposite circumstances. I am sure that the use of the knife has occasionally hastened the fatal event. My practice, for many years, has been not to interfere, if the disease is, on the one hand, in great degree dormant, or, on the other, uncommonly rapid in its progress. No conscientious surgeon will, of course, ever operate when there is extensive ulceration of the tumor, great involvement of the lymphatic ganglions, well-marked evidence of the cancerous cachexia, or co-existent malignant disease in other parts of the body. Occasionally, I have been induced to remove a carcinomatous breast merely with a view of making the poor patient more comfortable, by relieving her temporarily of pain, profuse discharge, and excessive fetor; but, in general, such a course is not advisable. It need hardly be added that encephaloid disease of the mamma always proves fatal more rapidly than scirrhus, whether it be let alone, or whether it be subjected to operation.

#### EXCISION OF THE BREAST.

Extirpation of this gland is generally a very easy and simple affair. It is only when the organ is much enlarged by disease, or when it is very vascular, that the operation is likely to prove annoying and embarrassing, especially if there be not a sufficiency of assistants. During its execution, the patient may either sit up or lie down, a posture which I always prefer, as it gives us better control over the parts, at the same time that chloroform may be administered with greater safety.

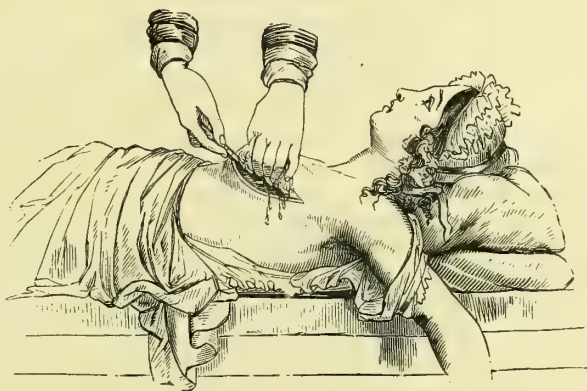
In most cases, it will be necessary to remove a portion of integument, particularly if the breast be at all large, or if there be any cutaneous involvement, either actual or impending. Hence the  
 Fig. 586. incisions should usually be elliptical, as shown in fig. 586; and it will always be well, if possible, to make them in the direction of the fibres of the great pectoral muscle, as this will tend to facilitate both the liberation of the organ and drainage after the operation. The surgeon, however, is not always able to control this matter, owing to the peculiar condition of the parts, and he will, therefore, occasionally be obliged to make his incisions very oblique, or, indeed, almost perpendicular. In all cases an attempt should be made to save enough integument for the easy reunion of the edges of the wound; for I deem it a matter of great moment that as much of the wound as possible should be healed by the first intention, believing that such a result will be much less likely to be followed by speedy relapse than when the wound is permitted to gap.

The integuments being properly stretched, and the arm held off nearly at a right angle from the body, the knife is thrust through the skin and cellulo-adipose tissue, and carried round the diseased mass in such a manner as to include every particle of it, the lower incision

being always made first. The dissection is then performed in the direction of the fibres of the pectoral muscle, which should be thoroughly exposed by the removal of its fibrous envelop. If any considerable-sized arteries spring, they should immediately be compressed by the finger of an assistant, and carefully tied as soon as the operation is over, together with any of the smaller branches that might afterwards become a source of hemorrhage. When the tumor is inordinately vascular, it may be prudent to ligate each vessel as soon as it is divided, but this is generally an awkward and unnecessary procedure. Before the parts are approximated, the wounded structures are examined with the greatest care, in order that not the slightest particle of the morbid substance may be left. In fact, the very atmosphere of the disease should be removed.

The adjoining sketch (fig. 587) affords a correct illustration of the position of the patient in this operation, and of the lines of the incisions.

Fig. 587.



If any of the lymphatic ganglions in the axilla are involved, they should be dealt with in the same manner as the breast, either by an extension of the outer angle of the incision, or by an incision immediately over the affected structure, which is then generally readily enucleated with the finger or the handle of the scalpel.

I make it an invariable rule, in excision of the mammary gland, not to approximate the parts until four or five hours after the operation, lest secondary hemorrhage should arise, and thus necessitate the removal of the dressings. The wound should be covered, in the interval, with a light, soft cloth, frequently wet with cold water. Care should be taken to use only a few stitches, and to press the flaps well down with long adhesive strips, aided by a compress and a bandage, carried around the upper part of the chest. The arm should be supported in a sling, the treatment should be strictly antiphlogistic, and the dressings should not, as a general rule, be disturbed until the fourth day. When there is a want of integument, or injurious tension, it will be well, in the former case, to borrow a sufficiency from the neighboring parts, and, in the latter, to ease the flaps by suitable incisions, practised a short distance from the edge of the wound.

## CHAPTER XVIII.

## SPECIAL EXCISIONS OF THE BONES AND JOINTS.

## 1. TRUNK.

## EXCISION OF THE CLAVICLE.

EXTIRPATION of this bone may be required on account of caries, necrosis, morbid growths, and displacement in consequence of disease. Mr. Davie, of Bungay, many years ago, excised the inner extremity of the clavicle in a case of dislocation backwards from deformity of the spine, the luxated head causing such a degree of pressure upon the œsophagus as to endanger life by inanition. Having made an incision from two to three inches in length over the bone, in a line with its axis, and severed its ligamentous connections with the sternum, he divided the bone about one inch from its articular end, by means of a Hey's saw, the soft parts being protected by a piece of sole-leather. The patient speedily recovered, and survived the operation six years. In my private collection is nearly the whole of the left clavicle, which I removed, in 1849, on account of necrosis, from a lad thirteen years old. In 1813, Dr. Charles McCreary, of Hartford, Kentucky, amputated the right collar-bone at its articulations for serofulous caries; the patient, a boy, aged fourteen, survived the operation many years, enjoying, it is affirmed, excellent use of the corresponding limb. A similar operation was successfully performed in 1852 by Dr. A. J. Wedderburn, of New Orleans, and in 1856 by Professor Blackman, of Cincinnati. In 1828, Dr. Mott removed the entire clavicle, on the left side, on account of an osteo-sarcomatous tumor, of great hardness, conical in its shape, and four inches in diameter at its base. The operation was one of immense delicacy and difficulty, requiring nearly four hours for its execution, and more than forty ligatures for the suppression of the hemorrhage. The patient, notwithstanding, made an excellent recovery, and, by means of an apparatus contrived for the purpose, had perfect use of the arm, being able to move it in all directions. The history of the case, with a detail of the different steps of the operation, will be found at length in the American Journal of the Medical Sciences for 1828, and also in Dr. Mott's edition of Velpeau's Surgery.

The entire clavicle has also been removed, on account of osteo-sarcoma, by Dr. Charles R. S. Curtis, of Chicago. His operation was performed in 1856, but the patient, a woman, aged twenty years, had a return of the disease at the cicatrice at the expiration of two months.



Recently a similar but more formidable operation was performed by Dr. E. S. Cooper, of California.

It is obviously impossible to lay down any definite general rules for the resection of this bone. When its removal is required on account of caries, necrosis, or displacement from disease, the operation is sufficiently simple, a single longitudinal incision, in the axis of the bone, affording ample space for its isolation and detachment. But the case is widely different when the clavicle is buried in a large mass of disease; when the circumjacent structures are all intimately matted together by morbid deposits; and when not only the great vessels of the neck, but likewise the phrenic nerve and the thoracic duct are in close proximity to the affected bone, as in the instance of Mott. Under such circumstances, the operation must be one of extraordinary difficulty, demanding the greatest patience, skill, and anatomical knowledge for its successful execution. The surgeon must proceed with the greatest circumspection, making constant use of the handle of the knife, keeping in close contact with the tumor, tying the arteries as they are divided, and guarding against the entrance of air into the veins, the danger of which is always considerable in the excision of morbid growths from the base of the lower cervical region. Trustworthy assistants must be at hand, and every emergency must be anticipated.

#### EXCISION OF THE SCAPULA.

Excision of this bone has now been so frequently performed as not only to establish its feasibility, but to prove that, when the cases are properly selected, it is comparatively devoid of risk. The cases of Mussey, McClellan, Gilbert, myself, and others, in some of which the entire scapula was removed with the clavicle, or with the clavicle and superior extremity, clearly evince what the human body is capable of enduring under dissections of a character apparently the most desperate. Dr. Mussey's first operation was performed in 1837; the patient had osteo-sarcoma of the scapula and clavicle, and both these bones were removed in their whole extent. The enormous wound healed almost completely by the first intention, and the man, when last heard from, fifteen years after the operation, was still well. In 1845, this distinguished surgeon successfully removed the entire scapula, with the outer-half of the clavicle and the upper-extremity, also for osteo-sarcoma. In 1838, Dr. George McClellan exsected this bone along with the clavicle on account of encephaloid disease; but the man died from a return of the malady six months after. In Dr. Gilbert's two cases, the excision was also performed for an encephaloid growth, and included in each the arm, the greater portion of the clavicle, and the neck and acromion process of the scapula. One of the patients survived the operation four months; the other only one week. In his last case, this excellent surgeon found that the performance of the operation was greatly facilitated by deferring the division of the clavicle until after the separation of the scapula, the weight of the arm drawing the tumor away from the chest and neck.

If it be impossible to lay down any specific rules for the performance of excision of the clavicle, it would be still more futile to attempt such an undertaking for the scapula. The truth is, every case must provide its own rules. The following instance, in which, in 1850, I removed nearly the whole of the right scapula for an osteo-sarcomatous affection, will serve to convey a general idea of the procedure necessary under such circumstances. It may be premised that the patient was a man, aged forty years, and that the tumor, which had been first noticed nine years previously, was fifteen inches in length by fifteen and a half in breadth at its widest part.

The patient being placed recumbent, with the body inclining towards the abdomen, an incision, sixteen inches in length, was made from the superior angle of the scapula to the inferior extremity of the tumor, its direction being obliquely downwards and inwards. Another, beginning about five inches below the upper end of the first, and terminating about the same distance from its lower end, was then carried, in a curvilinear direction, so as to include a small oval flap of skin in its centre. The integuments, which were exceedingly dense and thick, especially at the superior part of the tumor, were then dissected off from the surface of the morbid growth, first towards the spine, and then towards the axilla. Having detached the elevator and trapezius muscles, I sawed through the acromion process of the scapula just behind the clavicle, and then divided the broad dorsal and anterior serrated muscles. Carrying my fingers next underneath the tumor, and raising it up, I severed its connections with the ribs, cut the deltoid and other muscles of the arm, sawed the neck of the scapula, and thus removed the entire mass with comparatively little difficulty.

Fig. 588.



Several vessels were divided in the early stage of the operation, at the posterior and middle part of the tumor; but these were easily controlled by the fingers of the assistants. Several arteries near the neck of the bone bled so freely as to demand the ligature after the removal of the morbid growth. About twenty-four ounces of blood

were lost. The patient became very faint towards the close of the operation, and cordials were necessary to revive him. The immense wound thus produced was dressed with three interrupted sutures and adhesive strips, and supported by a compress and a broad body bandage. No untoward symptoms of any kind occurred after the operation; nearly the whole wound healed by the first intention; and, at the end of three weeks, the patient went home, gradually improving in health and strength. From exposure to cold, however, he con-

tracted pleuro-pneumonia, from the effects of which he died three months after the operation. The neck and glenoid cavity of the scapula were unaltered, but the remainder of the bone was completely disorganized. The tumor weighed upwards of seven pounds, and belonged to that class of structures usually, though vaguely, denominated osteo-sarcomatous. The external appearances of the tumor are exhibited in fig. 588.

## EXCISION OF THE RIBS.

Caries and necrosis of the ribs, both from disease and accident, are by no means uncommon, and often lead to the necessity of excision. These pieces are also liable to carcinomatous degeneration, and to different morbid growths, which can only be removed by the interposition of the knife and pliers. The annals of surgery afford numerous examples of excision of the ribs, from a portion hardly an inch in length to nearly the entire bone. Operations of this kind were probably performed at a very early period of the profession, and some very extraordinary cases have occasionally been published of their success. Thus, it is reported of Suif that he cut away from a man two of his ribs, making an opening into his chest capable of admitting the fist, and through which he removed, with complete success, a portion of diseased lung. Incredible as this case may at first appear, it has its analogue in one which occurred in the practice of Dr. Milton Antony, of Augusta, Georgia. In this instance, the fifth and sixth ribs, which were extensively carious, were removed along with two-thirds of the right lobe of the lung, the patient surviving the exploit nearly four months. The particulars of this remarkable case have been reported in the sixth volume of the Philadelphia Journal of the Medical and Physical Sciences. I have repeatedly excised considerable portions both of the ribs and of their cartilages; and at the College clinic, in 1857, I removed from a negro lad, aged seventeen, the central pieces of the sixth and seventh ribs, one of which was upwards of six inches in length, on account of scrofulous disease. During the operation, the apex of the heart could be plainly seen pulsating beneath the denuded structures. The boy rapidly recovered, and has ever since been in good health. Formidable operations upon the ribs, affected with various kinds of tumors, for the most part of a carcinomatous character, have been performed by different American surgeons, among whom it will be sufficient to mention the names of John C. Warren, George McClellan, and William Gibson.

In caries and necrosis of the ribs, excision may be performed with the greatest facility, as the diseased pieces are always more or less isolated by the morbid action, especially from the pleura, which is usually very much thickened and indurated, and, therefore, not at all in danger of being injured, unless great negligence is displayed. The intercostal arteries, too, are generally, under such circumstances, out of harm's way. In necrosis, a slight incision will commonly suffice to enable the surgeon to effect extraction, but in caries a more extensive incision, made in the axis of the affected bone, will be needed. If the



attachments are firm, the knife must be kept close to the bone, and it is safer here, as elsewhere, in similar cases, to use the handle of the instrument than its point. When the ribs are involved in morbid growths, excision will be environed with many difficulties, owing to the fact that the pleura generally retains its normal characters, and that it is then almost impossible to separate it from the affected structures without penetrating its cavity; moreover, such tumors are usually extremely vascular, and are apt to project to a considerable distance beneath the surrounding parts. As it respects the incisions necessary in such cases, the most eligible and convenient will be the T-shaped, semilunar, or elliptical.

#### EXCISION OF THE STERNUM.

The sternum has occasionally been excised, not wholly, of course, but in part, in consequence of caries, to which its substance is very subject in scrofulous and syphilitic persons, and on account of necrosis, gunshot injury, and compound fractures. Its affections are liable to be complicated with abscess in the anterior mediastium, thickening of the pleura, and lesion of the costal cartilages. The diseased portions may usually be gouged away or extracted without difficulty, exposure having been effected by a T shaped, or crucial incision. When the bone is largely implicated, without any tendency to spontaneous separation, the removal will be expedited by perforating it with the trephine, to admit the introduction of the elevator. In general, however, its substance is so soft that it may be easily cut away with the pliers, or even a stout, probe-pointed knife.

#### EXCISION OF THE PELVIC BONES.

The bones composing the framework of the pelvis are occasionally the seat of caries and necrosis, and there are few surgeons in extensive practice who are not occasionally obliged to excise portions of them. I have, in one instance, been compelled to remove the tuberosity of the ischium; in another, a large fragment of the iliac crest; and, on one occasion, a considerable piece of the posterior and lateral part of the sacrum. Exostoses sometimes form upon them, and may, unless deeply seated under the gluteal muscles, be easily removed with the knife and chisel.

The coccyx is liable to caries, in consequence of the contact of fecal matter in anal fistule; the same effect is occasionally produced by a blow or kick, or by injury inflicted by the pressure of the child's head in protracted parturition. Dr. Nott, of Mobile, some years ago, excised this bone on account of severe and intractable neuralgia seated in its substance, its lower extremity being hollowed out into a mere shell. A vertical incision was made behind, along the median line, when the bone was disarticulated at the second joint, and separated from its muscular and ligamentous attachments. The patient was a female, twenty-five years of age; the wound was long in healing, and a month elapsed before the pains disappeared from their original site.

## 2. SUPERIOR EXTREMITY.

## EXCISION OF THE BONES OF THE HAND.

Excision of the head of the phalanx of the thumb has sometimes been practised in compound dislocations and fractures, and the success attending the operation has afforded a warrant for performing it in case of caries of its substance. The joint is exposed by a free lateral incision, and the offending portion removed with the pliers. The cure will be more likely to be satisfactory if a small piece be clipped off from the contiguous bone, as the two raw surfaces, when brought together, will then unite more readily.

It is never desirable to exsect any of the *digital phalanges*, except the distal one; such a procedure would only leave a useless finger, and could, therefore, never become general. When the last phalanx is rendered carious, or deprived of its vitality, as so often happens in whitlow, the proper plan is to remove it through an incision extended along its palmar aspect; and it is well known that, when the periosteum is not destroyed, the bone, under these circumstances, is sometimes partially regenerated.

Excision of all the *carpal* bones has occasionally been attempted, generally in connection with that of the articulating extremities of the radius and ulna, but I am not aware that it has ever, in a single case, been followed by any satisfactory results. On the contrary, the disease for which the operation was performed has nearly always returned, and eventually led to the necessity of amputation of the forearm. It is questionable, therefore, whether the operation is worthy of repetition. It is different, however, when only a few of the carpal bones are in a carious state; then exsection of the affected pieces should be practised by all means, for if pains be taken to remove all the morbid structure, and no serious injury be inflicted upon the soft parts, particularly the sheaths of the tendons, there will be a very reasonable prospect of a good result, the hand not only preserving its usefulness, but also its symmetry. In several cases in which I adopted this method the effect was most satisfactory. The site of the piece to be removed will usually be indicated by a fistulous opening; if any formal incision is necessary it should be made upon the dorsal surface of the hand. A gouge and mallet will be indispensable instruments in the operation.

The *metacarpal* bones have frequently been removed in part, or in whole, for caries, necrosis, or external injury. The operation, which is sufficiently simple, consists in making a longitudinal incision along the dorsal aspect of the bone, in separating it from the soft parts by keeping the knife close against its surface, and in disarticulating it in the usual way. The carpal end of the bone, if sound, should be left, and in that case the division should be effected with the pliers. As the object is to preserve the finger, the extensor tendon is carefully drawn aside during the operation. The metacarpal bone of the thumb may be treated in a similar manner, the phalanges being retained;

and, although the member may not, for a time, be of any material use, yet as the soft parts become consolidated it will be found to be quite serviceable, to say nothing of the important part which it plays in preserving the symmetry of the hand.

#### EXCISION OF THE WRIST-JOINT.

Excision of the wrist-joint has been practised much less frequently than that of the other articulations, and in the cases in which it has been done, the result has not been at all encouraging. The operation, besides being awkward and difficult on account of the importance of the structures concerned in it, and the peculiar conformation of the joint, is extremely liable to be followed by permanent ankylosis of the wrist, and stiffness of the fingers. Another objection is that, when the carpal bones are involved in the disease, there is apt to be a return of the morbid action, eventually necessitating amputation of the forearm. Hence some surgeons prefer amputation in the first instance to the risk, pain, and inconvenience of excision without the certainty of a final cure. In opposition, however, to this decision, it may be urged that a stiff hand with the preservation of the mobility of even some of the fingers is very greatly to be preferred to no hand at all, both on the score of utility and seemliness, and that there are few persons who, if the matter were left to their own choice, would not rather submit to excision, if it afforded any reasonable prospect of success, than to the unconditional loss of so important and valuable a member.

There are two methods according to which this operation may be practised; in one the incisions are made along the inner and outer margins of the limb, in the other over its dorsal aspect, in the form of a semilunar flap, with the convexity downwards. When the disease necessitating the operation is limited to the ulna and radius, the former plan is to be preferred, but the latter, as affording more room, when the carpal bones participate in the disorganization. Whichever procedure be adopted, care is taken not to divide the extensor tendons of the fingers, as this would compromise their future usefulness, and thus frustrate the main object of the excision. The ends of the radius and ulna are removed on the same level, either with the pliers or with a narrow saw: in the flap operation it may be necessary, during the division of the bones, to protect the soft parts with a spatula or strip of leather.

#### EXCISION OF THE BONES OF THE FOREARM.

The bones of the forearm may require removal in part, or in whole, for caries, gunshot injury, or chronic enlargement. A case of excision of both the radius and ulna occurred, in 1853, in the practice of Dr. Compton, of New Orleans. The operation was performed on account of a compound, comminuted fracture, two months after the accident; both pieces being removed with the exception of the inferior extremity of the radius. The greater portion of the periosteum, which had been de-

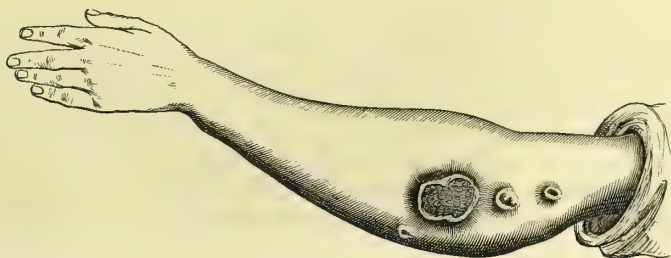


tached during the progress of the resulting inflammation, was left in the wound. The patient, a boy, aged fifteen years, made an excellent recovery, having a very good use of the hand. The forearm was three inches shorter than natural, and flexed at a right angle with the humerus.

Dr. Robert B. Butt, of Portsmouth, Virginia, exsected, in 1825, the entire *ulna* of the left side, in a man twenty-five years old, who, several years previously, had received a punctured wound in the wrist-joint, causing violent inflammation of the whole limb as far as the elbow, and ultimately terminating in hypertrophy and caries of the ulna, with immense thickening of the periosteum. Three months after the operation the man had so far recovered as to be able to pursue his occupation of a house-joiner, flexion, extension, and rotation of the joints being as free and uninterrupted as they had ever been. In 1853, Dr. Carnochan, of New York, performed a similar operation, taking out the entire ulna, which, as in the case of Dr. Butt, was excessively enlarged from one extremity to the other, measuring, at the base of the coronoid process, five inches and a half in circumference, and weighing nearly eight ounces. His patient was a man, thirty years of age, of a strumous habit, and the disease was supposed to have been occasioned by a sprain of the arm in splitting wood with a heavy axe. No untoward symptoms occurred during the after-treatment, and, with the exception of a depression, and the cicatrice along the inner aspect of the limb, no deformity was perceptible after the wound was healed. The functions of the forearm were preserved in a remarkable degree; the power of prehension was unimpaired; the limb could be flexed and extended at the elbow and wrist as well as pronated and supinated; the hand could be moved from side to side, and the fingers could be used as before the operation. Mr. Jones, of England, has also excised the whole ulna. In 1849, the late Professor C. P. Johnson, of Richmond, Virginia, successfully removed the middle two-thirds of this bone, on account of scrofulous disease.

I am not aware that the entire *radius* has ever been removed. During the session of 1857 I excised, at the College clinic, somewhat more than the upper half of the bone along with the outer condyle of the humerus, for scrofulous disease of several years' standing, the patient being a young Irishman in dilapidated health. He recovered well from the operation, but of the ultimate result I am unable to give any account, as the case was soon after lost sight of. The appearance of the limb, prior to the operation, is exhibited in fig. 589.

Fig. 589.



Mr. Erichsen states that he has resected the whole radius, with the exception of its articular head, which was sound, and that a useful arm was left. Excision of the lower four-fifths of this bone was performed by Professor Carnochan in April, 1857, his patient, a woman, aged thirty-one years, making an excellent recovery, the functions of the hand being so little impaired that she was able to perform her household duties nearly as well as before the operation. The bone was greatly diseased and enlarged.

Excision of the entire radius is performed by making a longitudinal incision along the posterior and outer aspect of the forearm, from the wrist to the elbow, and in detaching the bone carefully from its connections, with the precaution of inflicting as little injury as possible upon the surrounding structures. In caries, the bone is occasionally so slightly adherent that the periosteum may readily be peeled off from it by means of the handle of the knife, as happened in my case of partial excision. When the attachment is very firm, the rule is to keep the knife as closely against the bone as possible. Removal of the ulna is effected upon the same principle, but in this case the incision is carried along the posterior and inner aspect of the limb. In neither operation is it necessary to divide any of the principal arteries of the forearm, and hemorrhage from the smaller branches may be moderated by compression of the brachial by the fingers of an assistant. When the entire ulna or radius is removed, the proceeding will be facilitated by giving the wound, at each extremity, a curvilinear direction, or a short transverse cut may be extended from it at these points, either outwards or inwards, according to the nature of the bone concerned.

Exsection of the olecranon has been practised, in a few instances, for caries, or caries and necrosis. A T-shaped incision being made over the posterior part of the elbow, the process is detached from the tendon of the extensor muscle, and divided with the pliers or a narrow saw. The wound is accurately approximated by suture, plaster, and collodion, the limb is maintained at rest in the straight position, and, in due time, passive motion is instituted, to preserve the use of the joint.

Dr. Buck, of New York, excised the olecranon, in 1842, on account of hypertrophy of its substance from external injury, followed by total loss of flexion and extension, although pronation and supination partially remained. The patient recovered from the effects of the operation, but the limb, instead of being benefited, became permanently stiff.

#### EXCISION OF THE ELBOW-JOINT.

Excision of the elbow-joint has been practised more frequently than that of any other articulation in the body, and such has been the success attending it, that no doubt can any longer be entertained respecting its propriety. The operation was first performed by the elder Moreau, in 1797. It is usually required on account of caries, or caries and necrosis, of the heads of the contiguous bones, and should always be preferred to amputation of the arm, whenever it is possible to preserve a sufficiency of osseous matter to leave a good

limb. Experience has proved that the danger of excision of the elbow-joint is, in general, very slight, when the operation is limited to the articular extremities of the bones; when the medullary canal of the humerus is exposed, there is always risk of diffuse suppuration and pyemia, and the same is true, although not in so great a degree, of the medullary canal of the radius and ulna. Besides, the shorter the excised pieces are, the greater, other things being equal, will be the probability of a serviceable limb.

In regard to the mode of operating, surgeons have hitherto failed to agree upon any particular standard, for the reason, doubtless, that no one method is applicable to all cases. Mr. Park, by whom the procedure was originally suggested, although never practised, thought the object might be attained by a single longitudinal incision along the posterior part of the elbow, and the excision has often been effected in this way. Moreau used an H-like cut, by means of which he obtained two large flaps, which, being reflected in opposite directions, exposed the parts very freely. Some, again, avail themselves of a E-shaped incision; and I am myself an advocate for a semi-lunar one, the convexity looking downwards, on the ground that the wound made by it is more favorably situated for the escape of the discharges. In partial excision, a simple vertical incision will usually be quite sufficient for the purpose.

In performing the operation, the patient should incline somewhat towards his abdomen, but not to such an extent as to endanger the breathing during the exhibition of chloroform. Whatever plan of procedure be adopted, the incisions should be sufficiently ample to give the surgeon free room for the accomplishment of his main object. An assistant is ready to compress the brachial artery, in the event of there being any likelihood of much hemorrhage, which, however, will rarely be the case, unless the articular vessels, which will necessarily be divided, have become much enlarged from protracted irritation. Care is also taken not to injure the ulnar nerve, as it courses along the inner margin of the olecranon. If we adopt the semi-lunar incision, the knife should be drawn across the back part of the limb, from the superior extremity of one condyle to that of the other, for a distance of about two inches and a half; the flap being then raised, the ligaments, if still remaining, are severed by a cautious use of the knife, and the tendon of the three-headed extensor muscle separated at its insertion. The instrument is next passed closely round the olecranon, and this process removed with the pliers. The joint being now fairly exposed, the head of the radius and ulna are liberated from their connections, and thrust through the wound by forcibly bending the joint and pushing the forearm upwards. The saw is now applied, and the diseased structure excised, care being taken not to interfere, if possible, with the attachment of the two-headed flexor and anterior brachial muscles, as this would seriously compromise the future usefulness of the extremity. The articular end of the humerus is removed in the same manner. In cutting off the bones the ulnar nerve is drawn to one side with a blunt hook; but it is not necessary to protect the



parts in front of them, as the brachial artery lies securely under cover of the anterior brachial muscle.

It has been suggested that, when the articular ends of the bones of the elbow are only partially affected, the operation should be performed precisely in the same manner as when they are more extensively involved, and I heartily concur in this injunction; but such a procedure would certainly not be proper when the disease is limited to one of the bones of the forearm, as the radius, and the outer condyle of the humerus. Under such circumstances, common sense, as well as humanity, would dictate that the excision should be limited to the disorganized parts, the sound being left undisturbed, in the hope that they will, at least partially, preserve the functions of the joint. In several cases in which I have adopted this procedure, the result was highly gratifying.

During the after-treatment, the limb is placed almost in the extended posture, in a light tin case, with an opening at the elbow, to facilitate drainage. The ends of the bones are kept in tolerably close proximity with each other; for, as they are destined to unite by fibro-ligamentous tissue, it is important that this substance should be as short as possible. As the cure progresses, the forearm is gradually flexed, until, at length, it is brought to a right angle with the arm, passive motion being frequently practised, to prevent permanent ankylosis. When the after-treatment is judiciously conducted, there is not only usually no danger from the operation to the patient's life, but every reason to hope for a good result as it respects the use of the limb. Many of the persons that have been subjected to this operation were afterwards able to pursue, with great satisfaction, their former occupation. Mr. Cock, of London, in 1857, operated upon a man whose elbow had been excised, eighteen years previously, by the late Mr. Key, on account of scrofulous caries. He had enjoyed, throughout the whole interval, very excellent use of the limb until a short time before his admission, when, in consequence of an attempt to work with it in a new position, disease again appeared, requiring a slight operation, which promised to be followed by further relief. The case affords a beautiful illustration of the triumphs of conservative surgery.

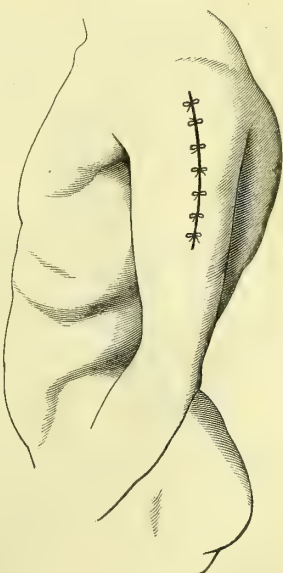
#### EXCISION OF THE SHOULDER-JOINT.

Excision of this articulation is rendered frequently necessary on account of caries and necrosis of the head of the humerus, or of this bone and of the contiguous surface of the scapula. It has also been done, in numerous instances, in consequence of gunshot injury of the shoulder, attended with laceration of the soft parts and comminution of the upper extremity of the humerus. The operation was first performed on account of disease of the humerus in 1769, by Mr. White, of Manchester, although a nearly similar procedure had been executed as early as 1740, by Thomas, of Pezenas, in Languedoc. No analysis, upon an extended scale, has yet been made, so far as I know, of the published cases of this excision, and it is, therefore, impossible to give anything like a definite opinion respecting its real value; enough,

however, is ascertained to satisfy me that it is incomparably more safe than amputation at the shoulder-joint, and that it ought to rank among the established operations of surgery. When properly executed, as it respects the selection of the cases, and the mode of the procedure, I believe that it will rarely, if ever, be followed by any bad effects, while the patient, in the great majority of instances, will have a very good use of his limb.

Various methods have been proposed and executed for the removal of the shoulder-joint; thus, some content themselves with a vertical incision, extending from the acromion process down through the belly of the deltoid, nearly as far as the insertion of this muscle; some, again, prefer a V-shaped cut, the base looking upwards; Moreau, who performed the operation a number of times, made a quadrilateral flap with the base below; Morel fancied that the easiest way of accomplishing the object was to make a semilunar flap over the most prominent part of the shoulder, not unlike that made in amputation; finally, Mr. Syme employs two incisions, a perpendicular one through the middle of the deltoid, and an oblique one extending upwards and backwards from the inferior angle of the first. It cannot be denied that some of these methods afford the surgeon most ready access to the joint, and enable him to effect excision of the humerus with the greatest facility; but then they have the disadvantage, and a very serious one it is, of inflicting most severe injury upon the deltoid muscle, in consequence of the oblique and more extensive division of its fibres, and of thus greatly protracting the cure. It is for these reasons that I have limited myself, in the operations which I have performed upon the scapulo-humeral articulation, to the simple perpendicular incision, as depicted in the annexed sketch (fig. 590); and I believe this will generally be found to answer every purpose, while it is entirely free from the objections here adverted to. In one of my cases, treated in this manner, I was enabled to remove, without difficulty, upwards of four inches of the humerus, and the recovery was most satisfactory. The operation is generally the more easy because, in caries of the joint, there is nearly always very considerable atrophy of the deltoid muscle and absorption of the subcutaneous adeps. The incision should begin just beneath the acromion process, and, descending nearly in a straight line through the cushion of the shoulder, should terminate within a short distance of the inferior attachment of the deltoid. The knife is carried down, at the first stroke, to the bone, which is then thoroughly liberated from its connections with the soft parts by means of a stout, blunt-pointed bistoury, passed closely round its neck, so as

Fig. 590.

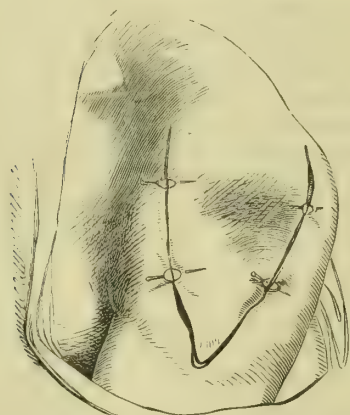


to sever the tendons of the subscapular and spinatus muscles, the long head of the biceps being left undisturbed. The capsular ligament is generally destroyed by the disease, but if any portion remain, it must be divided in the usual way. If more than the head of the bone requires removal, it will be necessary to separate any fleshy fibres that may be attached to its shaft. This step of the procedure may be greatly facilitated by the use of the instrument exhibited at page 589, fig. 311. The bone is now pushed through the wound by depressing the elbow backwards, and the whole of the diseased portion sawn off, the soft structures being carefully protected from the teeth of the instrument. If the glenoid cavity is involved in the morbid action, the affected substance is scraped or cut away; the acromion process is dealt with, if necessary, in a similar manner. The bleeding vessels being secured, the cavity is next washed out with cold water, the sinuses, if any exist, are properly pared, and the edges of the wound are approximated by suture and bandage, the arm being secured to the side of the body, and the forearm supported in a sling. To favor discharge, a small tent should be inserted into the lower angle of the wound.

The posterior circumflex artery is necessarily divided in this operation, and is frequently the only vessel that requires ligation. The axillary artery, vein, and plexus of nerves are entirely beyond the reach of the knife.

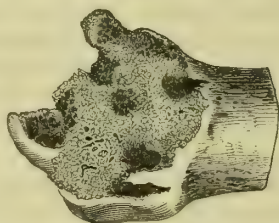
The flap operation, employed in excising the head of the humerus, is exhibited in the adjoining sketch (fig. 591). The procedure is one of great severity, and must sometimes be followed by grave consequences.

Fig. 591.



Flap, placed in position, after resection of the shoulder-joint.

Fig. 592.



Head of the humerus.

The diseased appearances of the head of the humerus, in one of my cases, are well illustrated in fig. 592. The bone was sawn off upwards of an inch and a half below its tuberosity. The specimen affords conclusive evidence of the impossibility of a cure, under such circumstances, by ordinary measures. The patient was a seafaring man, nearly forty years of age, sent to me by Dr. J. L. Peirce, of Bristol, Pennsylvania.



## 3. INFERIOR EXTREMITY.

## EXCISION OF THE BONES OF THE FOOT.

The principal articulations of the lower extremity which require to be dealt with in this way are those of the hip, knee, and ankle; excision is occasionally practised upon some of the tarsal and tarso-metatarsal joints, and the procedure not unfrequently results in a good use of the foot. But I am quite sure that such an operation should never be performed upon the metatarso-phalangeal articulations and upon the joints of the toes, for the reason that the anchylosed and abbreviated member could not fail to be sadly in the way of the patient's convenience and comfort when he comes to wear his boot. The rules which apply to excision of the bones of the metacarpus and fingers, are altogether irrelevant here, on account of the differences in the uses to which these parts are subjected. The hand is essentially a prehensile organ; hence, even if only one finger, although that should be the little one, or the metacarpal portion of the thumb, can be preserved, we shall render the possessor a most valuable service. The foot, on the contrary, is an organ of support, serving to receive and sustain the weight of the body during progression, and in the erect posture. The longer and broader, therefore, it is the better it will be able to perform its important offices. But there is another view of the subject which must not be overlooked in a parallel of this kind; it is this, that, while the hand is perfectly free, the foot is constantly incased in a tight boot or shoe, a circumstance which renders it absolutely essential to the comfort of the patient that the whole limb, but more particularly the toes, should be as free from prominences and cicatrices as possible. It is for these reasons that the toes, when fatally injured or diseased, are never removed at their articulations or in their continuity, but always at their metatarsal junctions; when the operation is practised at these sites, as it occasionally is by young and thoughtless surgeons, the stump is always in the patient's way, and usually requires secondary amputation. Moreover, it is not only important that the foot should be free from painful and inconvenient scars and prominences, but that it should be firm and solid, otherwise it cannot possibly serve the purposes of a basis of support. We may excise a metacarpal bone, and yet, if proper care be taken during the after-treatment, the corresponding finger will retain, not only its symmetry, but also, in a considerable degree, its usefulness. But the result is very different when we remove a metatarsal bone without the toe with which it is articulated; as soon as the support afforded by that bone is gone, the member is unable to sustain itself, and, as a consequence, it constantly drops away from its fellows, to the great discomfort and annoyance of the individual. I believe, then, that excision of the bones and joints of the toes and metatarsus ought, as a general rule, to be superseded by amputation, as altogether more likely to leave a serviceable and symmetrical limb.

Professor Pancoast was the first, I believe, to exsect the articular surfaces between the great toe and its metatarsal bone, the case being

one of caries. Having raised a semilunar flap at the inner side of the joint, the diseased ends were removed with the saw, when the parts were approximated in the usual manner, the shortening being three-fourths of an inch. A good recovery ensued. During the treatment the extensors were disposed to pull the end of the toe upwards; an occurrence which, as Dr. Pancoast has suggested, might readily be counteracted by their subcutaneous division.

The objections that have been urged here against excision of the toes and metatarsus, cannot apply to exsection of the bones of the tarsus; the utility of the operation has, in fact, been tested in numerous instances, and, although it is impossible to lay down any specific rules for its performance, yet any surgeon of ordinary skill or anatomical knowledge may undertake it with a reasonable hope of success. The great difficulty of the procedure depends upon the close and intimate manner in which the different pieces of the tarsus are connected together, the thickness of the plantar tissues, and the course and depth of the plantar arteries. This, however, may generally be overcome by attacking the bone to be removed either from the margin of the foot, or from its dorsal surface, where the soft parts are comparatively sparse and unimportant. A useful guide to the diseased bone is commonly afforded by one or more sinuses, the situation of which is nearly always indicated by a red papula of granulations and more or less discharge of sanious fluid.

Caries of the foot is the disease for which excision is most commonly required, and experience long ago demonstrated that the tarsal bones are those which are most liable to suffer in this way. Not unfrequently, however, the heads of the metatarsal bones participate in the lesion, and occasionally, again, they are its exclusive seats. It rarely happens, according to my observation, that only one bone either of the tarsus or metatarsus is affected; in general, at least two or three pieces are in a carious condition, and cases arise where every one suffers, the foot presenting a horribly swollen and deformed mass, full of sinuses, and the seat of excessive pain. Under such circumstances, of course, nothing short of amputation will afford any chance of relief, and the sooner it is performed the better.

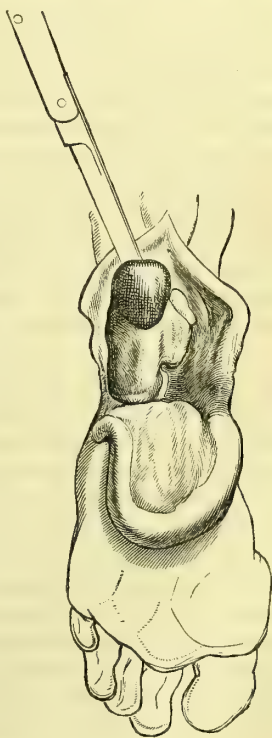
When the caries is limited to the cuneiform bones, to these bones and the heads of some of the metatarsal bones, or, lastly, to the cuneiform bones and the adjoining portions of the cuboid and navicular bones, excision deserves a decided preference over amputation, and I am satisfied that the operation, if properly executed, that is, in a bold and uncompromising manner, the surgeon removing all the diseased structure, will generally be followed by highly satisfactory results. I have repeatedly removed nearly the whole of the cuneiform bones, together with the heads of several of the metatarsal, and also considerable portions of the cuboid and navicular, and yet the patient had a most excellent and useful foot, answering all the purposes of the natural limb. Access is easily obtained by a large horseshoe flap, with the convexity downwards, upon the dorsum of the foot, care being taken not to injure the sheaths and tendons of the extensor muscles. The removal of the affected bones, whether in part, or in

whole, must be effected by the cautious use of the gouge and mallet, aided by strong, narrow, probe-pointed knives, and long-bladed, slender pliers. Several mops must be at hand for sponging out the deep cavities made in the operation; and the bleeding, which, however, is seldom profuse, must be controlled, after the excision is completed, by compression, with or without styptics, according to the exigencies of the case.

The *calcaneum* has been exsected in numerous instances, but for the most part only partially, on account of caries, necrosis, and fracture. Dr. Carnochan, of New York, and Dr. Morrogh, of New Jersey, have each recently reported a case of successful excision of the entire bone. I have myself on two occasions removed the whole of the heel portion of the calcaneum for necrosis. When the entire bone requires excision, the best mode of procedure will be that recommended by Mr. Erichsen, inasmuch as we are thereby enabled to preserve the integrity of the sole, a circumstance of great consequence to the patient after his recovery from the operation. In the various proceedings heretofore practised the incisions are carried into the plantar region, so that the cicatrices are afterwards subjected to the pressure and friction of the shoe during progression, and rendered liable to pain, induration, and ulceration. In the case reported by Dr. Carnochan, the sole was not entered, but as the proceeding was somewhat more complicated than that suggested by the English surgeon, I feel inclined to accord the latter the preference.

The following description and drawing of Mr. Erichsen's operation are taken from the second edition of his *Surgery*, issued in 1857: "The patient lying on his face, a horseshoe incision is carried from a little in front of the calcaneo-cuboid articulation round the heel, along the sides of the foot, to a corresponding point on the opposite side. The elliptic flap thus formed is dissected up, the knife being carried close to the bone, and the whole under surface of the os calcis thus exposed. A perpendicular incision about two inches in length is then made behind the heel, through the tendo-Achillis in the mid-line and into the horizontal one. The tendon is then detached from its insertion, and the two lateral flaps dissected up, the knife being kept close to the bones from which the soft parts are well cleared (fig. 593). The blade is then carried over the upper and posterior part of the os calcis, the articulation opened, the interosseous ligaments divided, and then by a few touches with the point, the bone is detached from its connections with the cuboid,

Fig. 593.





which, together with the astragalus, must then be examined, and if any disease is met with, the gouge should be applied. By this operation all injury to the sole is avoided, and the open angle of the wound being the most dependent, a ready outlet is afforded for the discharges."

When the parts are thoroughly cicatrized the patient may walk about with the aid of a shoe with a high heel stuffed with horse-hair, but great care must be taken for a long time not to bear too much weight upon it.

It is not easy, in the present state of the science, to determine whether the *astragalus*, when invaded by caries or necrosis, should be excised, or whether the case should be subjected to amputation. The fact that the operation has occasionally been performed successfully, the patient not only escaping with his life, but having afterwards a good limb, does not, in my judgment, prove that it should, as a general rule, be employed under the circumstances here indicated. The operation has, unquestionably, terminated fatally in a majority of the instances in which it has been resorted to, whether for the relief of disease, luxation, or fracture, and this fact affords of itself a strong argument against its repetition; but the reason for its abandonment derives additional force when we consider the great difficulty of its execution, and the liability, in the case of caries, of a return of the morbid action, or, in the case of accident, of causing disease in the neighboring bones, with which the astragalus is so intimately united, and which must necessarily be more or less severely injured during the exsection, however carefully it may be done. It is a good plan in every operation of this kind, for the surgeon to place himself mentally in the situation of his patient, and to ask himself, whether, if he were the subject of grave disease of the astragalus, he would prefer excision to amputation? If he had all the facts on both sides of the question, on the one hand, the great danger of excision, the violent inflammation which would be sure to follow it, and the probability of a relapse of the disease; and, on the other, the comparative safety of amputation, the freedom from subsequent suffering, and the certainty of an excellent stump, one which might be readily adapted to an artificial limb, he would hardly hesitate as to the course he would pursue. He would unquestionably decide in favor of the removal of the leg above the ankle, or at the joint by Pirogoff's or Syme's method.

When excision of the entire astragalus is performed for caries, limited to its own substance, the best plan will be to expose the ankle-joint at its anterior and outer aspect, by a semilunar flap, with the convexity downwards, taking care not to injure any of the more important soft parts. The bone is separated, first, from its connections with the tibia and fibula, then from those with the calcaneum, and finally from those with the navicular bone. After its lateral attachments have been severed, the disarticulation will be materially facilitated by inclining the foot forcibly backwards, at the same time that an attempt is made with a stout pair of forceps to draw the astragalus out of its bed in the opposite direction. The cutting must be done with a thick, narrow, probe-pointed knife, kept close against the bone in order to avoid the plantar arteries, especially the internal, which would otherwise be in

danger. The operation being completed, the calcaneum is brought up into the gap between the two malleolar prominences, where it is carefully maintained by appropriate apparatus, the foot resting at a right angle with the leg. Great attention will be required during the after-treatment to prevent retraction of the heel by the action of the gastrocnemial muscles. Slight motion is occasionally procured between the contiguous surfaces, but, in general, there will be permanent ankylosis. The limb will necessarily be somewhat shortened.

I have in my possession a cast, kindly presented to me by Dr. James H. Hutchinson, of this city, which admirably shows the appearances of the foot and ankle after the removal of the entire astragalus. The patient was a boy, eleven years of age, on whom Dr. Peace performed the operation, at the Pennsylvania Hospital, in March, 1858. He had been hurt, about seven months previously, by a fall from a haymow, which was followed by severe inflammation, and soon after by ulceration of the integuments, leaving an opening large enough to admit the little finger. Several small pieces of bone came away before his admission, and the remainder of the mass was afterwards extracted without difficulty. When the lad went home, last September, the sore had closed, and he was in excellent health, as I ascertained by a personal examination. The foot, which had a tendency for a time to turn inwards, was nearly at a proper angle, but was found, on accurate admeasurement, to be three-quarters of an inch shorter than the sound one, while the difference in the length of the legs was only about three lines. Some motion existed at the ankle-joint, which has no doubt since increased.

Partial removal of the astragalus may be effected by the gouge, and it will frequently be well, here as elsewhere, for the surgeon, when he begins the operation, to take some sinus in the neighborhood of the ankle-joint as his guide, a slight enlargement of the opening being often sufficient to enable him to obtain ready access to the seat of the disease.

In a case of caries of the astragalus and calcaneum, which occurred to Mr. T. Wakley, of London, that gentleman excised both these bones, together with the malleolar extremities of the tibia and fibula, and had the satisfaction of saving his patient, recovery taking place with a strong and useful foot.

Excision of the *cuboid* and navicular bones does not require any particular notice. When both these bones are involved in disease, the other pieces of the tarsus, and even those of the metatarsus, are also very apt to suffer, and then the question will arise whether Chopart's amputation should not supersede resection. When the cuboid alone is carious, it may easily be dug out with the gouge, but the operation will probably necessitate the removal of the fifth metatarsal bone with the little toe. Partial excision of the navicular bone may be effected in a similar manner.

## EXCISION OF THE ANKLE-JOINT.

The ankle-joint not unfrequently suffers from scrofulous caries, as seen in the adjoining drawing (fig. 594) from a clinical case; it is also

Fig. 594.



liable to necrosis, especially in cases of compound fractures and dislocations, followed by excessive inflammation. For the relief of these lesions the surgeon usually resorts to amputation of the lower part of the leg, and there can be no question that, as a general rule, it is by far the most expedient procedure, involving hardly any risk to life, and affording an excellent stump. In caries, however, of long standing, where the disease is limited to the articular surfaces of the joint, without any serious implication of the surrounding tissues, excision may be practised with a reasonable prospect of success, a strong and useful, although somewhat shortened, limb being left. The operation was first performed in 1792, by the elder Moreau, but, till lately, has not had a place in surgery, and even now professional sentiment is much divided in regard to it. It is done most conveniently by making two vertical incisions, extending along the inner and outer margins of the leg, from the level of the ankle to a height of from two and a half to three inches; the lower angle of each cut is then connected by a semilunar one carried across the upper part of the instep, and the flap thus marked off being dissected up, the joint is exposed, the soft structures carefully detached from the two bones, and the articular ends turned out, and sawn off, if possible, on the same level. If the astragalus is diseased, the affected part is now removed with the gouge or pliers, when the raw osseous surfaces are placed in accurate apposition, and so maintained until consolidation has occurred, passive motion being duly attended to in order to obtain a short fibro-ligamentous rather than a bony union. In detaching the soft parts from the tibia and fibula; and severing their extremities, the utmost care must be taken not to injure the tibial arteries or the tendons of any of the long muscles of the foot.



## EXCISION OF THE KNEE-JOINT.

It is not a little remarkable, when we consider the great size of the knee-joint, the importance of the structures which surround it, and the intimate sympathetic relations which exist between it and the rest of the system, that it should have been the first articulation which was subjected to excision for the relief of disease. The only plausible explanation which can be given of it is the fact that it is so frequent a seat of white swelling, or scrofulous ulceration, which, until after the middle of the last century, was never thought of being treated in any other manner than by the removal of the affected parts by amputation of the thigh. It would appear from the history of exsection of this joint that Mr. Filkin, of Norwich, was the first to perform the operation, his case having occurred in 1762; as, however, no account of it has appeared in print, no attention was attracted to it until the publication of the famous case of Mr. Park, of Liverpool, in 1781. The news of this achievement having reached France, Moreau, the elder, of Bar-sur-Ornain, was induced to make trial of it, in 1792, upon one of his patients, a young man, laboring under white swelling. In 1809 the operation was performed by Mr. Mulder, of Gröningen, in 1823 by Mr. Crampton, of Dublin, and in 1829 by Mr. Syme, of Edinburgh, the latter surgeon repeating it soon after in another case. From this period nothing of special interest occurred in regard to excision of the knee-joint until 1850, when it was revived by Mr.ergusson, of London. Since then the operation has been practised in numerous instances; and, although the results have been far from being uniformly successful, yet enough has been done to show that the procedure, if properly executed, holds out great promise of a strong and useful limb, in a class of cases which were formerly regarded either as entirely hopeless, or as remediable only by amputation. One of the most able and zealous champions of the operation at present, is Mr. Butcher, of Dublin, who has perhaps done more than any one else to reduce it to rule.

The *statistics* of this operation are of deep interest. In regard to the earlier cases, those of Filkin and Park completely recovered, the patient of the latter having obtained so sound a limb as to be able to go to sea and perform all the duties of a sailor. Moreau's patient died several months after the operation, of dysentery; of Crampton's two cases, one recovered with a good limb, and the other perished at the end of three years and a half, exhausted by hectic irritation and repeated attacks of erysipelas. Of Mr. Syme's patients one got well, and the other died.

Mr. P. C. Price, of London, has recently collected the particulars of 160 cases of excision of this joint, performed in Great Britain since 1850, on account of disease, deformity, and accident, and of these 32 proved fatal, or in the ratio of 1 to 5. In 8 death was caused by pyemia, in 6 by exhaustion, in 5 by irritation, in 4 by shock, and in the remainder by various affections. It is proper to add that, in many of the cases, the operation was performed as a *dernier resort*, on account of exten-

sive and protracted disease of the articulation, attended with a worn-out state of the system. In 18 of the 160 cases, the results of the excision were so unsatisfactory as to require amputation of the thigh. Of these 18 operations only one terminated fatally.

Of 127 cases lately collected by Dr. Geraldès, 33 proved fatal. Of 19 cases subjected to resection, between 1762 and 1730, 12 died. Of 108 cases operated upon since that period, only 21 proved fatal, thus showing an immense diminution in the mortality of resection, as performed in more recent times.

Mr. Humphrey, of Cambridge, England, has recently reported the particulars of 13 cases, in which he excised the knee-joint, on account of chronic disease, of which only one proved fatal, although four were subsequently obliged to submit to amputation. In operating upon young persons, Mr. Humphrey suggests the propriety of making the section through the epiphyses, and not through the shaft of the bones, lest, their growth being thus arrested, great deformity from shortening should occur.

Assuming that these data afford a fair average result, it will be perceived that the mortality from excision of the knee-joint is considerably less than that from amputation of the thigh, for which it may, therefore, under favorable circumstances, be employed as a suitable substitute.

In regard to the manipulations, various plans have been suggested, any one of which will afford ready access to the diseased bones, but they are all objectionable, on the ground that the most dependent part of the wound being closed, there is no outlet for the discharges. To remedy this difficulty it has been proposed to pierce the posterior wall of the wound, and to insert a gum-elastic tube to carry off the fluids as fast as they are secreted; a circumstance of paramount importance both as it respects the speedy restoration of the parts and the prevention of pyemia. There can hardly be any doubt that many, if not most, of the accidents that have followed this operation have been due, directly or indirectly, to the accumulation of pus in the bottom of the wound, and its consequent injurious action upon the bones, irritating and eroding their substance, and burrowing more or less extensively among the soft parts. Such, however, is the character of the tissues behind the articulation as to render it impracticable to approach the femur and tibia in that direction, or to leave the operator any choice in regard to the place of election.

Mr. Park readily accomplished his purpose by means of a crucial incision, the centre of which corresponded with the superior extremity of the patella, the perpendicular cut being nearly six inches in length, while the horizontal one reached almost half around the limb, which was in an extended position. Moreau, on the other hand, made an H-shaped incision, that is, a longitudinal incision along each side of the thigh and leg, between the vasti and flexor muscles, and a transverse one just below the patella. I prefer myself a large semi-lunar flap, made by carrying the knife across the upper part of the leg, from one condyle to the other; this being carefully raised, affords a sufficient opening for all necessary purposes, for dividing the connecting liga-

ments, separating the soft parts, and turning out and sawing off the ends of the bones. In general, not more than an inch of the femur should be removed, and a still smaller slice should, if possible, be taken from the tibia; sometimes, however, it is necessary to cut off much more, the tibia, for example, below its articulation with the fibula, and the femur above its condyles, and yet a useful limb be left. If any sinuses are found to extend into the substance of these bones, after they have been sawn off, they should be followed up with the gouge, and every particle of disease be scooped out, with the same care and patience that the dentist drills out the cavity of a tooth preparatory to the introduction of the plug.

In most cases of disease of the knee-joint requiring excision, the patella is implicated in the morbid process, and should, therefore, be removed along with the other bones; this course, however, necessarily involves the division of the tendon of the four-headed extensor muscle, and consequently the loss of any action which that muscle might exert upon the movements of the leg, in the event of the formation of an artificial joint during the progress of the case. Hence the preservation of the tendon becomes a matter of great interest, as tending to augment the strength and usefulness of the limb. This can only be accomplished, however, when there is but little disease of the tibia and the patella; for when the tubercle of the former bone is obliged to be excised, the tendon, or ligament, necessarily loses its attachment, and had, therefore, better be removed with the latter. All the ordinary proceedings contemplate the ablation of the patella, and I am quite satisfied that it is, as a general rule, the most judicious practice, even when this bone is perfectly healthy. When the patella is retained, its articular surface should be divested of its cartilage, to promote its union with the surface of the femur, also previously rendered raw. If, notwithstanding this precaution, consolidation fail to occur, and the patella be found to interfere with the cure, lying loose under the integuments, and thus keeping up irritation, no time should be lost in removing it altogether.

During the *after-treatment* the limb should be retained in the extended position, if much substance has been removed, but slightly flexed under opposite circumstances, in order to place it in the most favorable condition for usefulness in the event of ankylosis, which is so liable to happen after excision of the joints, notwithstanding all the precautions that may be taken to prevent it. One of the most annoying occurrences to be guarded against is the tendency which the tibia has to be drawn outwards and backwards, in consequence of the action of the flexor muscles of the thigh. The best means of counteracting this disposition is the bandage, applied from the hip downwards, the leg being invested in the usual way; or, this failing, the subcutaneous section of the tendons of the offending muscles. When osseous union is expected, the bones should be sawn off a little slopingly behind, so as to enable the parts to afford the degree of flexion essential to the production of a serviceable limb. In this case the extremity should be placed over a double-inclined plane, and be well supported with lateral splints, to prevent bowing of the leg.



It might be supposed that, during the sawing of the bones, the popliteal artery would necessarily be endangered, but this is not the case, the vessel lying altogether beyond the line of the instrument. The hemorrhage, indeed, is usually very slight, ligation of the articular branches being all that is generally required.

#### EXCISION OF THE PATELLA.

The patella, though not often diseased, is occasionally affected without the femur and tibia participating in the morbid action. In a man who was under my care, some years ago, the bone was completely exposed, and almost entirely necrosed, from frost-bite, its surface being as black as charcoal, and its substance greatly softened. By means of the gouge I cut away nearly the whole thickness of the bone, leaving merely its inner table, pared the edges of the ulcer in the soft parts, and using warm water-dressings, succeeded in effecting an excellent cure, the joint gradually recovering from the stiffness into which it had been thrown in consequence of its protracted disuse.

#### EXCISION OF THE BONES OF THE LEG.

Excision of the long bones of the lower extremity can only be practised, to a certain extent, as the removal of any considerable portion would deprive the limb of its solidity, and so render it useless as an instrument of progression and support. Several inches of the shaft of the femur might be exsected, and yet, if osseous union occurred, the thigh would answer an excellent purpose. In badly treated fractures the limb is often shortened to this extent, the patient walking well afterwards with the aid of a high-heeled shoe. A loss of several inches of the body of the tibia would be a serious accident unless it were accompanied by a corresponding loss of the fibula, in which case, solid union taking place, a good leg might result, while, if the fibula retained its integrity, the limb would not be sufficiently firm for locomotion.

To the above statements the fibula forms a striking exception. The loss of a portion of this bone, or even the whole of it, except its malleolar extremity, does not, as is well known, materially affect the functions of the leg and foot. Exsection of the entire fibula, originally proposed by Desault, was first executed by Percy and Laurent; Seutin has also performed the operation, and other surgeons, as Beclard and Elliot, have removed considerable pieces of it; generally on account of caries, caries and necrosis, or hypertrophy from syphilitic disease. The bone being exposed by a longitudinal incision, is carefully isolated at its superior extremity, and either disarticulated from the tibia or divided with the pliers. Taking now hold of this part, and using it as a handle, the operator cautiously detaches the remainder of the bone from its muscular connections, and, lastly, from the tibia and astragalus below, keeping all the while the point of his knife as closely against the osseous surfaces as possible. The exsection is usually attended with a good deal of hemorrhage, and, unless great caution be em-

ployed, the peroneal artery will be likely to be wounded. During the after-treatment care must be taken to prevent inversion of the foot, to which there is generally a decided tendency whenever the external malleolus is removed.

## EXCISION OF THE HIP-JOINT.

Excision of the hip-joint, or, more correctly speaking, of the head and neck of the femur, has occasionally been practised for gunshot injury and chronic disease; but the operation never met with much favor in the latter class of affections until recently, although nearly a century has elapsed since the attention of the profession was directed to the subject by Mr. Charles White, of Manchester, England, who was the first to suggest the feasibility of the procedure. It does not appear, however, that he ever put the idea to the test of experiment. This credit was reserved for Mr. Anthony White, of London, who performed the operation successfully in 1818. His patient was a lad, fourteen years old, affected with coxalgia, who, notwithstanding the loss of four inches of the femur, made an excellent recovery, living for a number of years after in perfect health.

The operation was not repeated, anywhere, until 1823, when Mr. Hewson, of Dublin, excised the extremity of the bone above the small trochanter; the case, however, terminated unfavorably, the patient dying three months after from disease of the acetabulum, followed by abscess of the pelvis. A more fortunate result attended the undertaking of the German surgeons, Schlichting, Köhler, and Heine, which took place a short time subsequently to that of the Irish practitioner, recovery ensuing in every instance.

Although the operation has been performed rather frequently during the last fifteen years, chiefly through the influence and example of Mr. Fergusson, of London, yet such is the want of statistical information upon the subject that it is extremely difficult, if not impossible, to arrive at any well-founded conclusions respecting its value, or even its propriety. The great objection that has been urged against it is that, in coxalgia, the morbid action often extends to the acetabulum, if not also into the pelvic cavity; and some, indeed, have even gone so far as to assert that this is always the case in the more confirmed stages of the disease, which, however, is not true, as my dissections fully satisfy me. But granting, for the sake of argument, that it is, the fact would not, in my opinion, constitute a valid objection against the procedure, seeing how easy it would be, in most instances, to gouge out all the carious structure, and thus leave the parts in a condition for gradual reparation. When the acetabulum is deeply involved, a circumstance, however, which cannot always be determined beforehand, either from the symptoms or an examination with the probe, the case will, of course, be proportionably more unfavorable, but even then we need not despair of an ultimate cure, provided the operation be conducted with the requisite care and skill. Left to themselves, such cases nearly always prove fatal, life being gradually worn out by hectic irritation and profuse discharge. Assuredly, then, unless the patient is

in an utterly forlorn condition, both science and humanity would dictate the propriety of interference in the hope of rescuing the individual from his impending fate. I am satisfied that conservative surgery has not yet had fair play in this class of cases of hip-joint disease; the objection, I conceive, ought not to lie against the operation, but against the time at which it is performed, which is often too late to afford the benefits which it would otherwise be capable of conferring.

Fig. 595.



When the head and neck of the thigh-bone alone are diseased, excision, early and judiciously practised, will not only prevent much suffering, but be instrumental in saving many lives. When the disease has committed such ravages as are displayed in fig. 595, from a drawing of one of my clinical cases, it is impossible for any surgeon to produce a good result.

In contemplating the manual part of the operation, several plans suggest themselves to the consideration of the surgeon. In the first place, he may adopt the method followed by White, of making simply one longitudinal incision, in the axis of the head and neck of the bone, of which he was thus readily enabled to remove four inches; or, he may give his incision a T, L, or V-shaped appearance; or, finally, what is preferable to any of these procedures, he may form a semilunar flap of the gluteal muscles, with the convexity downwards. This plan of incision has the advantage not only of allowing free access to the joint, but also of affording a ready outlet for the discharges at the lower and outer angle of the wound. The superior extremity of the femur being thus exposed, is thrust through the opening by

carrying the limb across the sound one, and then pushing up the knee, when it is to be divided immediately below the limits of the morbid action, by means of a narrow saw, the soft parts being carefully protected from injury during the movements of the instrument. Any disease that may exist in the acetabulum, whether at its margin or in its bottom, is to be freely removed with the gouge. There is not much bleeding, but a few small arteries may require ligation. The wound is approximated in the usual way, a small tent being inserted at the external and inferior angle; and the limb is placed in a carved splint, with a window opposite the joint, to admit of the necessary examination and dressing. Until the primary effects of the operation are over all attempts at extension and counter-extension will be likely to prove extremely painful, if not positively abortive; but by degrees this must be rigidly attended to, lest the limb, when well, should be too short to be either seemly or useful. One of the difficulties experi-



enced after the operation is to keep the end of the femur in contact with the acetabulum.

In 1854, Dr. Lewis Sayre, of New York, published a paper on excision of the hip-joint, embracing a tabular view of 30 cases of which 20 recovered, and 10 died. Mr. Erichsen states that, so far as he has been able to ascertain, the operation has been performed 38 times, with 14 deaths as its direct result.

#### EXCISION OF THE GREAT TROCHANTER.

Excision of the great trochanter is occasionally required on account of caries of its substance. Professor Willard Parker, a few years ago, performed an operation of this kind with very gratifying results, and it has also been done several times by others. Mr. Fergusson has had two cases, one of which proved fatal at the end of the first week, in consequence of an attack of erysipelas. The operation itself is not difficult of performance, the carious prominence being easily exposed by a longitudinal or slightly curvilinear incision, and removed with a small saw, the gouge, or the pliers. The hemorrhage is usually inconsiderable. The two circumflex arteries are only endangered when we are obliged to carry the knife deeply and extensively around the base of the trochanter. The excision of the bone will be greatly facilitated if the limb be thoroughly inverted during the operation. When more room is required than usual, the surgeon may make a T-shaped incision, with the base downwards, to afford a better outlet for the discharges.

## CHAPTER XIX.

## SPECIAL AMPUTATIONS.

## 1. SUPERIOR EXTREMITY.

## AMPUTATIONS OF THE HAND.

THE fingers may require removal either in their continuity or at their articulations. When the distal phalanx alone is involved, as when it is in a carious or necrosed condition, the operation should, if possible, be limited to the bone, the nail and soft parts being preserved. In disease of the bone from whitlow, such a procedure is nearly always feasible, and, when the periosteum has not been destroyed, is not unfrequently followed by a reproduction of the phalanx, although rarely in a perfect manner. It is only, therefore, when the parts have been crushed by machinery or some other cause, that, as a general rule, the finger should be cut off at the last joint. The operation is performed by making a short, semilunar incision from one side of the finger to the other, on its dorsal surface, the convexity presenting towards the nail (fig. 596). Turning back the integument, the

Fig. 596.



Amputation of the finger, at the distal articulation.

knife is inserted into the articulation, and the ligaments being divided, it is drawn forwards, in close contact with the palmar aspect of the bone, so as to form a large, convex flap, which is then retained by several points of suture.

In amputation of the finger in the continuity of the second phalanx, the operation may be performed either by the circular method, or by two flaps taken laterally or from the dorsal and palmar surfaces, the bone being divided with a sharp pair of pliers. It is hardly neces-

sary to add that it is always desirable to save as much of the member as possible, both on account of utility and seamliness.

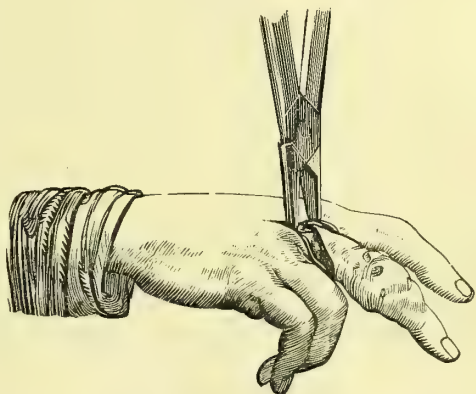
Excepting the index-finger, amputation should never be performed at the first phalangeal articulation, as the stump thus left would not only be disfiguring, but inconvenient. Hence, when the operation is required, it is much better to remove the bone at its junction with the metatarsal bone. This may readily be done by making two lateral flaps by circumscribing the posterior extremity of the first phalanx by two long, semilunar incisions, commencing at the centre of the knuckle of the metatarsal bone behind, and terminating at the middle of the palmar aspect of the member on a level with the web of the contiguous fingers. During the disarticulation the finger is forcibly flexed so as to afford an opportunity of severing the extensor tendon above the joint, as it would otherwise be in the way of the stump. Before approximating the flaps, the projecting portion of the knuckle of the metatarsal bone should be cut off (fig. 597) with the pliers, in order to give the part a more seemly appearance. Generally two small arteries require the ligature. During the cure, the fingers must be confined upon a curved splint, otherwise they may overlap each other, and thus become in a great measure useless.

In amputating the index-finger, a very useful stump may be formed by disarticulating the middle joint, especially in laboring subjects, or in those engaged in mechanical pursuits. In the

rich, on the contrary, the hand will present a better appearance if the finger be removed at its connection with the metatarsal bone.

It is seldom that all the fingers are simultaneously affected by disease, so as to require removal at the metacarpo-phalangeal joints, but such a procedure may become necessary on account of accidents crushing the bones and extensively bruising and lacerating the soft parts. The operation, which is sufficiently easy of execution, is performed by making two flaps, one on the dorsal, and the other on the palmar aspect of the hand, by two incisions, slightly convex in front, the posterior extending over the roots of the fingers, about half an inch in front of their junction with the metacarpal bones, while the anterior one is carried across the hand on a line with the web of the fingers. The best plan is to form the dorsal flap first, and then, after having reflected it back, and divided the tendons and ligaments, to fashion the other by cutting from above downwards, and from behind forwards. The appearance of the stump will be greatly improved if the projecting portion of each knuckle of the metatarsal bones be sloped off a little with the pliers.

Fig. 597.





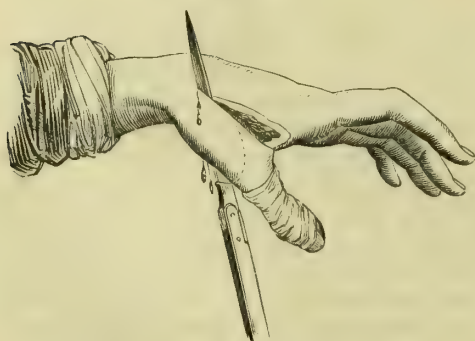
A useful, and not unseemly stump may be formed by amputating the metacarpal bones in their continuity, leaving, perhaps, the thumb or one of the fingers, the principal flap being taken from the substance in the palm of the hand. In case of accident, crushing the bodies of these pieces, the operation might be performed through their posterior extremities, from a third of an inch to three-quarters of an inch in front of their junction with the second row of carpal bones, or even at the carpo-metacarpal articulations, although, from the irregularity of the contiguous surfaces, the task would by no means be an easy one, nor would the resulting stump be as smooth as it ought to be, either for usefulness or seemliness.

Cases occur, both of accident and disease, demanding the removal of one of the metacarpal bones. The operation is executed by making a triangular incision over the back of the hand, the apex of which is directed towards the wrist, while the base extends round the root of the finger in front, hardly any integument being removed. The extensor tendon being cut far back, the bone, isolated from its muscular connections, is either separated at its carpo-metacarpal articulation, or divided in its continuity, in a sloping manner, by means of the pliers.

Amputation of the *thumb* at the distal joint or in the continuity of its first phalanx may be performed in the same manner as amputation of the fingers, and does not, therefore, require any particular notice. When both its bones are fatally implicated, whether by disease or accident, the hand will exhibit a much more seemly appearance if the member be removed at the carpo-metacarpal joint. For this purpose a triangular incision is made along the radial aspect of the hand, beginning about one inch in front of the styloid process of the radius, one line extending to the centre of the web between the thumb and index-finger, while the other passes round the outside of the head of the metatarsal bone, a little behind the joint, both meeting in front of

the palm (fig. 598). The muscles being now detached, and the extensor tendons severed behind, the disarticulation is readily effected by bending the thumb forcibly inwards towards the ulnar margin of the hand. In performing the operation the hand is placed in a state midway between pronation and supination, the fingers being fully extended and the thumb abducted. Care must be taken not to include too much integu-

Fig. 598.



Amputation of the thumb and metacarpal bone.

ment in the incisions. When the flaps are properly shaped, they usually unite by the first intention, and leave a very insignificant cicatrice.

The *little finger* is sometimes removed along with the metacarpal

bone at its junction with the unciform bone. Two incisions are made over the back of the hand, extending from the carpo-metacarpal articulation forwards, along each side of the root of the finger, and terminating at the centre of its palmar aspect, on a line with the web which connects it with the ring-finger. The soft parts are now carefully detached from the bone, which is then forcibly flexed and disarticulated by inserting the knife into the back of the joint. Unless this rule be closely followed, the operation will prove difficult on account of the peculiar conformation of the articulating surfaces of the two bones.

## AMPUTATION AT THE WRIST.

Disarticulation at the wrist should always be preferred to amputation of the forearm whenever it is practicable, inasmuch as the mutilated extremity affords a much longer lever, which may afterwards be used with great advantage for various purposes, at the same time that it is more easily adapted to an artificial hand. I have repeatedly seen persons who, after this operation, enjoyed an amount of action in the limb that was truly astonishing, and who expressed very great satisfaction at having so good a weapon of defence in accidental pugilistic rencounters, the long stump enabling them to deal a most powerful blow. The operation is performed by making two flaps, an anterior and posterior, about an inch and a half long, the convexity looking forwards towards the hand (fig. 599). They should be formed by cutting from without inwards, as we are thus enabled to give them a much better shape. The incision should extend from the styloid process of the ulna to that of the radius, which should be previously felt for, and then taken as guides to the knife. The disarticulation is effected by inserting the instrument into the posterior part of the joint, the hand being forcibly flexed, and held perfectly prone at the time. This step of the operation will be greatly facilitated if the surgeon bear in mind the peculiar conformation and arrangement of the two surfaces of the joint. The hand being removed, the styloid processes are cut off on a level with the cartilaginous incrustation of the ulna and radius, when, the arteries of the wrist being tied, and the extensor and flexor tendons, if necessary, properly retrenched, the flaps are approximated and retained in the usual manner.

Fig. 599.

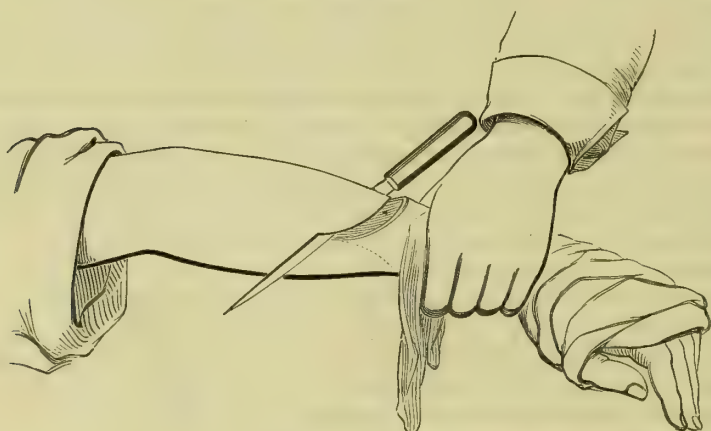


Amputation at the wrist.

## AMPUTATION OF THE FOREARM.

The forearm may be removed in its continuity in any portion of its extent, but when the surgeon has his choice, the operation should be performed as low down as possible, for the reason that, as stated in the preceding paragraph, the longer the stump is the more useful it will be. The flap method is the one which I usually prefer, but the circular also answers exceedingly well, and is regarded by many as altogether superior to the other. When the limb is very fleshy, it is best to form both flaps by transfixion, one on the anterior, and the other on the posterior surface of the forearm (fig. 600); but, under opposite cir-

Fig. 600.



Amputation of the forearm.

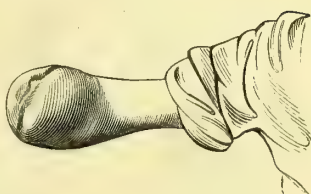
cumstances, one should be fashioned by cutting from without inwards, and the other by cutting from within outwards, as we are thus enabled to give them a more suitable shape and size. The extremity is held in a state midway between pronation and supination, the brachial artery is compressed by a tourniquet or the fingers of an assistant, the interosseous structures are divided on a level with the retracted flaps, and the saw is worked in such a manner as to sever both bones simultaneously, or, if practicable, the ulna a little before the radius, as the latter, from its more direct connection with the hand, affords a better support during the operation, and thereby prevents splintering of the osseous tissue. This occurrence, however, may, in general, be effectually obviated if the surgeon, during the sawing of the two bones, takes care to apply his thumb and fingers strongly to the interosseous space.

In performing the circular operation, it is advisable, on account of the smaller quantity of tissue, to draw the soft parts forcibly back by means of a three-tailed retractor, but such a procedure is never necessary when the amputation is done as here described. The radial, ulnar, and interosseous arteries alone generally require ligation.



I have seen some cases of amputation of the forearm only about two inches, or two inches and a half below the elbow, with a most excellent result, the stump being rounded off and well shaped, perfectly movable, and quite serviceable. The annexed drawing (fig. 601), taken from the parts several years after such an operation, exhibits the appearance of the limb.

Fig. 601.



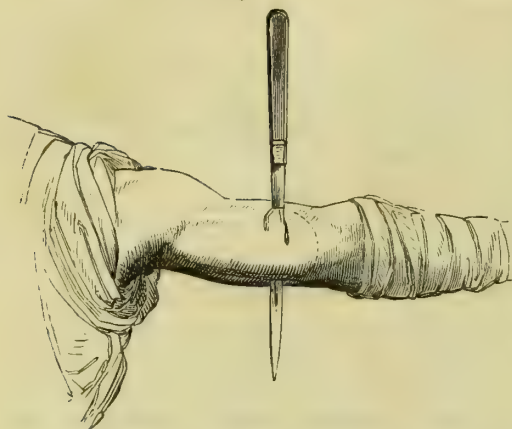
#### AMPUTATION AT THE ELBOW.

Amputation at the elbow is performed but seldom, a circumstance which is the more surprising when we consider what an admirable stump it leaves, what little risk it involves, and how promptly the parts usually heal. Besides these advantages, which experience has fully established, the operation is one of the most easy in surgery, and may, therefore, be performed by any one having a competent knowledge of the anatomy of the joint. Two flaps are formed, the principal one in front of the elbow, at the expense of the muscles in that situation, and the other, which is entirely cutaneous, behind, the length of the former varying from two and a half to three inches, according to the diameter of the limb. The forearm being slightly flexed, so as to bring the sharp edge of the coronoid process on a line with the articular surface of the humerus, the surgeon transfixes the structures in front of the joint, on a level with the two condyles, and carrying the knife downwards in close contact with the bones, thus forms the anterior flap, taking care not to give it too great a degree of convexity. The posterior flap is then made by drawing the knife across the back part of the limb, in a somewhat semilunar direction, the ends of the incision connecting themselves with those of the preceding one. The next step of the operation consists in dividing the ligaments which unite the radius and ulna to the humerus, and in sawing the olecranon process from before backwards, leaving all that portion which lies above the level of the joint, and which receives the insertion of the three-headed extensor muscle. It is not necessary to interfere with the articular cartilage of the humerus, but it will improve the shape of the stump if we cut off the outer trochlea of that bone on a line with its other surface, and this, indeed, is usually done in severing the olecranon. The brachial artery commonly escapes division in this procedure.

#### AMPUTATION OF THE ARM.

In amputating the arm, the same general rules are applicable, as it respects the point of election, as in the removal of the forearm, already described. The stump should be as long as possible; and the best covering for it is obtained by taking two flaps, one from the anterior, and the other from the posterior aspect of the limb, the former being usually formed last, as it contains the brachial artery. The soft parts

Fig. 602.



being firmly grasped, and held away from the bone, the transfixion is effected in the usual manner, the knife being carried downwards for a distance from two and a half to three inches, according to the dimensions of the limb (fig. 602). When the muscles are very large and firm, the surface of the flaps should be rather concave, to prevent redundancy of substance. The bone being sawn, the brachial artery and its

branches are secured, and the flaps approximated by suture and plaster. The circulation in the limb, during the operation, is controlled by compression of the axillary artery, or of the subclavian above the clavicle.

#### AMPUTATION AT THE SHOULDER.

Of the numerous plans that have been devised for amputating the shoulder-joint, I shall content myself with an account of the following, an acquaintance with which will enable the surgeon readily to meet any emergency that may arise in practice, whether civil or military. In performing these operations, the circulation in the limb must be controlled by compressing the subclavian artery above the clavicle, either by means of the handle of a large key, or, what will answer much better, my compressor, described and delineated in the chapter on amputations, vol. i. page 631. The head and chest should be well elevated by pillows, and the shoulder should be brought over the edge of the table, so as to allow the knife the most perfect freedom.

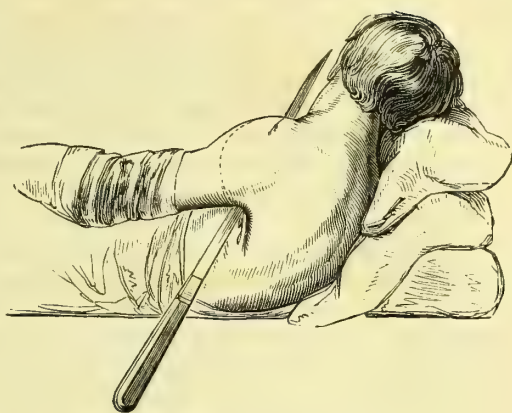
Amputation at the shoulder-joint is one of the most easy operations in surgery. Richerand long ago remarked that it might be performed with the same celerity with which an adroit carver separates the wing of a partridge, and nothing is more true, although I have occasionally seen a case in which the surgeon consumed time enough not only to cut up the whole bird, but also to devour it.

1. One of the best methods of performing this operation is that of Baron Larrey, which consists in making two oval flaps, one in front and the other behind (fig. 603), each being from three to three inches and a half in length. The limb being held horizontally, away from the body, with the hand in the prone position, the knife is introduced immediately beneath the acromion process of the scapula, and carried down through the centre of the belly of the deltoid muscle, for about two inches and a half, when, changing the line of direction, it is drawn

round the upper extremity of the humerus, as far down as the centre of the axilla, the flap thus formed exhibiting a well-marked convexity in front. A similar flap is then made on the opposite side, when the elbow is carried forcibly backwards, behind the level of the trunk, to facilitate the disarticulation, which is effected, by cutting closely from above downwards, round the margin of the glenoid cavity (fig. 604).

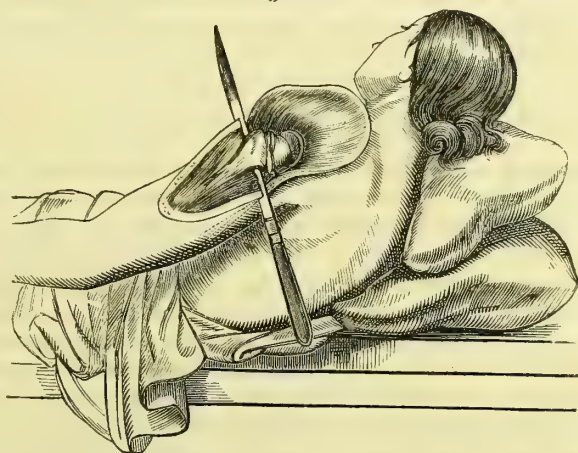
Instead of forming the flaps as here directed, they may be made by transfixion, or cutting from within outwards, although the former is, on the whole, the better method.

Fig. 603.



Amputation at the shoulder.

Fig. 604.



2. Supposing the left shoulder to be the subject of amputation, the knife is introduced at the inferior margin of the axilla, and brought out about half an inch beneath the clavicle, just beyond the acromion process. By now drawing the instrument downwards, in close contact with the humerus, a large flap is formed, at the expense, mainly, of the deltoid and broad dorsal muscles. The capsular ligament being put upon the stretch by carrying the elbow across the front of the chest, disarticulation is readily effected, and the other flap formed by cutting the soft parts on the antero-internal portion of the limb. If the right shoulder be the seat of operation, the transfixion must be commenced above.

3. Lastly, an excellent stump may be formed by making the flaps



at the outer and inner aspects of the joint. The elbow being elevated so as to depress the head of the humerus, and the cushion of the shoulder raised, the knife, supposing the left side to be the subject of operation, is thrust in at the posterior margin of the deltoid and brought out at the anterior, the flap being formed almost exclusively of the substance of that muscle. The soft parts being held up, the exposed joint is entered in the usual manner, and the other flap made at the expense of the structures in the axilla, by cutting from above downwards.

The statistics of this amputation exhibit a less flattering result than one might have been led to anticipate from a consideration of the size of the articulation and the nature of the structures concerned in its execution. From the tables of Dr. Stephen Smith, of New York, published in 1853, it appears that, of 71 cases occurring in various American and European hospitals, 34 proved fatal, thus showing a mortality of nearly 50 per cent. The advantages of primary over secondary amputation at the shoulder-joint, in military practice, are well illustrated by the facts furnished by the late Mr. Guthrie. Thus, of 19 cases in which the operation was performed soon after the receipt of the injury, all save one recovered; whereas, out of 19 others, which underwent secondary amputation, 15 died. The tables of Dr. Smith embrace 39 cases of disarticulation of the shoulder-joint in American practice. Of these 13 were fatal, and one doubtful, being a mortality of upwards of 33 per cent.

## 2. INFERIOR EXTREMITY.

In performing the more important amputations of the inferior extremity, the circulation is usually most effectually controlled by compression of the femoral artery, in the upper portion of its course, by means of the tourniquet; or, if the patient be very thin, by the fingers of a trustworthy assistant. In removing the foot and lower part of the leg, the compression may be applied to the popliteal artery. In describing amputation at the hip-joint, special mention will be made of the manner of preventing hemorrhage in that operation. When recourse is had to the tourniquet, the surgeon takes care, before applying the instrument, to elevate the limb, and press the blood out of the superficial veins from the heel upwards. This precaution is particularly important in weak, anemic subjects, in whom the loss even of a few ounces of blood is often followed by the most serious consequences.

### AMPUTATION OF THE FOOT.

The toes are never removed in their continuity or at the phalangeal articulations, inasmuch as the stump thus left would only be in the way of the patient, and thus occasion serious inconvenience, if not positive suffering, from being constantly impinged upon by the shoe or boot. It is for this reason that the operation should always be performed at the metatarso-phalangeal joints; and this may be readily done when all the toes are involved, as, for example, in gangrene and

frost-bite, by taking the principal flap from the plantar aspect of the foot. The amputation is commenced by making an incision across the back of the limb, from one side to the other, immediately in front of the metatarso-phalangeal articulations, which, the integuments having been dissected up, are then entered with the knife, an ordinary narrow-bladed scalpel, and successively divided from above downwards, the operation being finished by carrying the instrument forwards to a level with the web of the toes, in order to obtain a sufficiently large covering from the sole of the foot. There is no necessity for cutting off the ends of the metatarsal bones. Any bleeding vessel that may exist being ligated, the plantar flap is stitched in place, and maintained by adhesive strips, aided by an appropriate bandage.

When only one of the smaller toes is to be removed, the operation should be performed with oval flaps, as in amputation of the fingers at the metacarpo-phalangeal articulation (fig. 605). The disjunction will be facilitated by forcibly flexing the toe. The extensor tendon should be divided above the joint.

Fig. 605.

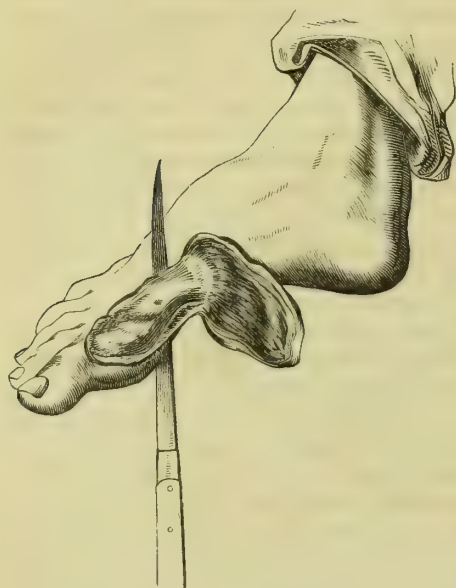


When the great toe requires removal, the operation should be performed through the continuity of the metatarsal bone, and not at the metatarso-phalangeal articulation, as in this case the large head of the metatarsal bone would sadly interfere with the wearing of the boot. Two incisions are made along the dorsum of the foot, commencing at an acute angle a short distance in front of the internal cuneiform bone, passing round each side of the toe anteriorly to the joint, and terminating at the centre of the web which connects the big toe with the adjoining one. The soft structures being carefully detached, the metatarsal bone is sawn through in a sloping direction, including fully one-half of its length. The sesamoid bone is removed along with the extensor tendon of the toe. The wound usually heals very promptly, and the cicatrice, corresponding with the dorsum of the foot, is seldom productive of inconvenience when the patient begins to walk, especially if proper attention has been paid, during the operation, to the preservation of the integument.

When the whole of the metatarsal bone requires removal, the operation is performed with a large flap, extending from a little in front of the metatarso-phalangeal joint to a few lines beyond the internal cuneiform bone. The whole process will readily be understood by a reference to the cut (fig. 606).

The foot is sometimes removed at its *tarso-metatarsal* junction. The operation, however, is seldom practised, owing to the fact that it is rare that the diseases and accidents requiring such a procedure are confined entirely to the metatarsal bones; besides, such is the manner in which these pieces are connected to each other, and to the tarsal bones, that it is one of unusual difficulty. When deemed necessary, it should be executed according to the plan originally suggested and described by Mr. Hey, of Leeds, in his *Practical Observations in Sur-*

Fig. 606.



gery. The operator, taking the tubercle of the fifth metatarsal bone and the projection of the scaphoid as his guides, forms a large convex flap on the side of the foot, by carrying his knife as far forwards as the ball of the toes. In order to give more precision to his incision, a line may previously be traced in ink across the foot, along which the knife is then passed in the transfixion; or, what is preferable, the flap is made by cutting from without inwards, and from before backwards. The latter is the method which I generally adopt, because it enables us to give the flap a rounder and smoother shape, thereby avoiding the necessity of trimming it after the operation is completed, as

is usually the case when performed in the ordinary way. The dorsal flap is comparatively small, and is composed entirely of integument; it is slightly convex, and is easily made with a large scalpel. The soft parts being dissected up, each joint is entered separately, the disarticulation being expedited by bending the anterior extremity of the foot forcibly backwards. In executing this step of the operation, it is important to remember the oblique shape of the fifth metatarsal bone, at its articulation with the cuboid, and the peculiar manner in which the head of the second metatarsal bone is locked in between its fellows, as well as the distance to which it projects behind the level of the tarso-metatarsal junction. Owing to these circumstances it is generally extremely troublesome to disengage it; and hence it is always best to leave it by sawing through its body on a line with the other joints. The plantar and dorsal arteries being secured, the flaps are carefully adjusted, and the limb is supported, in an easy and relaxed position, upon its outer surface, to counteract the action of the gastrocnemial muscles, which might otherwise draw the foot out of place.

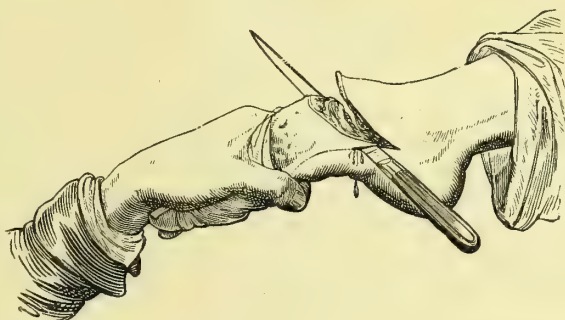
In caries, as well as in injury of the metatarsal, cuneiform, cuboid, and scaphoid bones, the foot may occasionally be removed in such a manner as to leave merely the astragalus and calcaneum, the principal flap being obtained from the sole. The operation is usually known as *Chopart's amputation*, but the name of Mr. Syme is also generally associated with it, that gentleman having been the means of reviving it by recalling to it the attention of the profession in Great Britain and this country. Of the utility of this procedure, in the class of cases under consideration, there can no longer be any doubt; I have employed it several times in my own practice, and I have seen it repeat-



edly executed by others, and in every instance that has come within my notice, the result has been most satisfactory. The stump, although short, is extremely useful, affording an admirable support for the limb, the person generally walking well without the assistance of a cane. In one of my cases the individual, a young countryman, was able, in less than six months after the operation, to plough and do all the usual work of a farm hand with the greatest facility and comfort.

In performing the operation a short flap is made in front of the foot, by an incision extending round its dorsal surface, from one side of the member to the other, in a curvilinear direction, the convexity looking

Fig. 607.



Chopart's operation.

forwards (fig. 607). It should begin precisely midway between the outer malleolus and the head of the fifth metatarsal bone, which indicates the site of the calcaneo-cuboid articulation, and terminate on the inner margin of the foot, directly opposite, at the astragalo-navicular articulation. The integument being dissected up, the blade of the knife, which should be sharp-pointed, and at least six inches in length by half an inch in width, is thrust into the two joints just mentioned, and being brought out below, is next carried forwards, in close contact with the bones, as far as the ball of the toes, in order to form the inferior and main flap. The only arteries which usually require to be tied are the dorsal and two plantar. The extremity of the plantar flap should be well rounded off before it is stitched to the dorsal, and during the cure special care should be taken to keep the gastrocnemial muscles completely relaxed, by placing the leg upon its outer surface over a pillow. From neglect of this precaution the stump is liable to be retracted, so that the cicatrice, by constantly coming in contact with the ground, is apt to ulcerate and cause severe suffering.

Fig. 608.



Stump after Chopart's amputation.

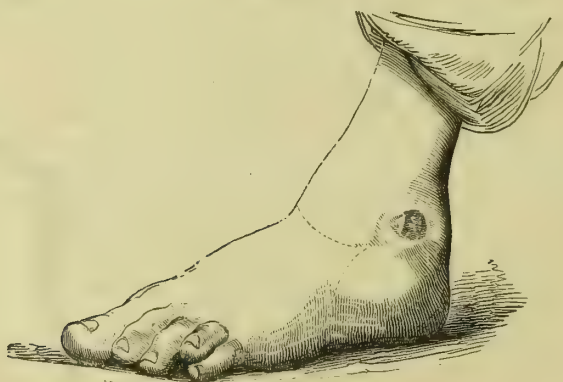
Should such a contingency arise, the proper remedy will be the subcutaneous division of the tendo-Achillis; an operation which need never be performed in anticipation of this occurrence, since it may always be effectually avoided if the requisite care be taken during the after-treatment. The adjoining drawing (fig. 608), taken from life, exhibits the ordinary appearances of the stump.

#### AMPUTATION AT THE ANKLE.

Although amputation at the ankle-joint has long been known to the profession, yet the credit of popularizing it is justly due to the teachings and influence of Professor Syme, who performed it for the first time in 1842. Since then he has repeated it upwards of thirty times, and his example has now been so frequently followed by others, in America as well as in Europe, that it may be regarded as one of the established operations in surgery. Less dangerous than amputation of the leg in its continuity, it is particularly adapted to those cases in which there is caries of the posterior tarsal bones, especially the astragalus and calcaneum, without any involvement of the ends of the tibia and fibula. When such involvement exists, except in a very slight degree, the limb should be taken off higher up, otherwise it will be difficult, if not impossible, to prevent a recurrence of the disease.

Syme's amputation—for so this operation is now generally distinguished—is performed with two flaps, one of which is taken from the front and the other from the sole of the foot, the two meeting at the outer and inner ankle. The best instrument is a large scalpel;

Fig. 609.

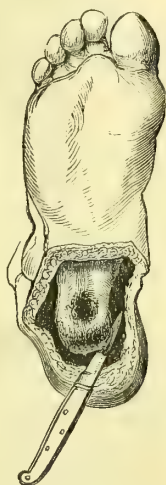


Amputation at the ankle.

the foot is placed at a right angle with the leg, and the circulation is controlled by means of the tourniquet applied to the popliteal artery. The operation is commenced by making a perpendicular incision from the centre of one malleolus to that of the other directly

across the sole of the foot, and then carrying another, of a curvilinear shape, with the convexity looking forward, over the fore part of the limb, so as to join the two points of the former at an angle of  $45^{\circ}$ . The lines of these cuts are well seen in the accompanying drawing (fig. 609). The anterior flap is now carefully raised, the astragalus disarticulated, and the posterior flap dissected off from the calcaneum, by passing the knife closely over its surfaces (fig. 610) in order to avoid wounding the tibial artery. The tendo-Achillis being severed from its connections, the operation is finished by sawing away the two malleoli and a thin slice of the tibia, just enough to include its cartilaginous incrustation. The posterior flap thus formed, consisting of the thick and hardened cushion of the heel, offers an admirable covering for the exposed bones, to which it usually unites by the first intention, and which afterwards enables them to bear pressure with great facility. The only objection to it is that, unless special care is taken in its adjustment, it may form a sac for the accumulation of matter, thus greatly retarding the cure. This, however, is generally easily prevented by the proper application of the bandage in dressing the stump at and for some time after the operation. Should this contingency, however, arise, relief must be afforded by a small puncture through the plantar surface of the flap.

Fig. 610.



In performing this operation there are three points which deserve special attention. The first is not to have a redundancy of flap, which will seldom happen if they are both shaped in the manner here described; the second is not to cut any holes into the posterior flap while severing its connections with the calcaneum; and the last is not to divide the posterior tibial artery prior to its separation into its plantar branches, otherwise sloughing of the soft parts might ensue. If these precautions be observed, it will be difficult to make a bad stump. When the cure is completed, the limb will be from an inch to an inch and a half shorter than natural.

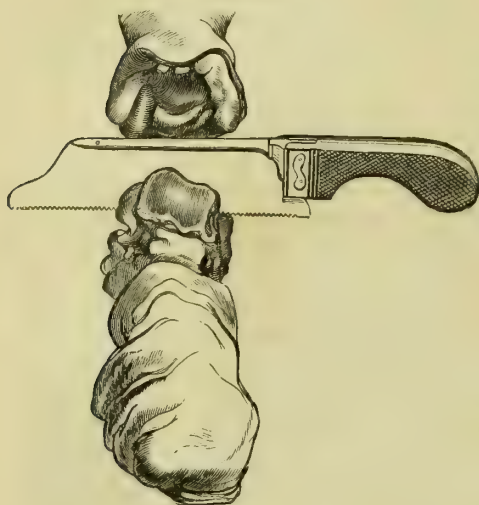
When, in consequence of disease, the flaps cannot be formed according to the plan now laid down, they may be taken from the sides of the limb, including as much of the integument of the heel as possible. The operation is easy enough of execution, but the cicatrice after the healing of the stump will be much in the way of the patient's comfort, and may lead to the necessity of amputating the limb higher up.

The operation of Mr. Syme was modified a few years ago by Mr. Pirogoff, of Russia, by retaining a portion of the calcaneum, and thus imparting greater length and rotundity to the stump. It is performed as in the ordinary disarticulation of the ankle, by making a curvilinear incision round the foot in front, and a perpendicular one under the sole, extending from the fore part of one malleolus to that of the other. The anterior flap being dissected up, the knife, a short, stout



bistoury or scalpel, is introduced into the joint so as to divide the different ligaments, and detach the astragalus. The saw is now applied

Fig. 611.



just behind the astragalus, and moved downwards and forwards, in order to separate the anterior portion of the calcaneum, as seen in fig. 611. The operation is completed by removing the two malleolar projections, along with a thin layer of the articulating extremity of the tibia, tying the vessels, and stitching the flaps accurately together. The advantages of this procedure are that we obtain not only a larger stump, but one that is better adapted to bear pressure, that there is no danger of wounding the posterior tibial artery, and that the posterior flap is not so

liable to form a pouch for the lodgment of pus. When the dressing is completed, the upper surface of the calcaneum is in immediate contact with the lower surface of the tibia and fibula, and in consequence of this arrangement, the parts will necessarily be some time in healing, the consolidation of the contiguous bones taking place slowly, though very perfectly. In operating upon the cadaver, I have ascertained that an excellent stump may be made by bringing the wedge-shaped portion of the heel-bone up between the malleolar processes of the tibia and fibula, their cartilaginous surfaces being previously well abraded. It is worthy of consideration whether the parts, when thus treated upon the living subject, would not afford a better support for useful progression.

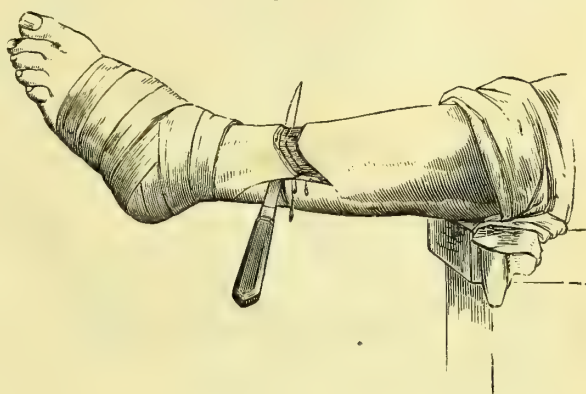
#### AMPUTATION OF THE LEG.

The leg should never be amputated, if possible, lower down than two and a half or three inches from the ankle; for here, as elsewhere, the rule is to afford the patient a long stump for the more ready adaptation of an artificial limb. The state of the parts, however, concerned in the injury or disease requiring the operation does not often leave us room for choice, and hence we are generally obliged to cut off the extremity much higher up than would otherwise be desirable. The mode of performing the amputation must necessarily vary according to the portion of the leg which is the subject of it.

When the operation is performed in the inferior third of the leg, two flaps are formed from the sides of the limb, by cutting from without inwards; or, instead of this, one may be made in front, and the

other behind, as depicted in the drawing (fig. 612). Composed entirely of integument in front, they receive a considerable quantity of muscular substance behind, and should each be from two inches to

Fig. 612.



Amputation of the leg at its inferior third.

two inches and a half in length. The interosseous tissues are divided on a level with the retracted flaps, and the two bones are sawn in such a manner as to sever the fibula before the tibia. Three principal arteries usually require the ligature. The edges of the wound are approximated vertically, to facilitate drainage. Fig. 613 exhibits the shape of the stump as obtained from a sketch from life.

Fig. 613.

The circular operation makes an excellent stump when the leg requires removal in the lower-third of its length; I have practised it in several instances, and in every case, save one, with the most gratifying results, the persons being able to walk with great facility, with the aid of an artificial limb. In the exceptional case, the wound gaped, and the bones became necrosed some days after the operation, owing, apparently, to some defect of the constitution, which ultimately caused the death of the patient.

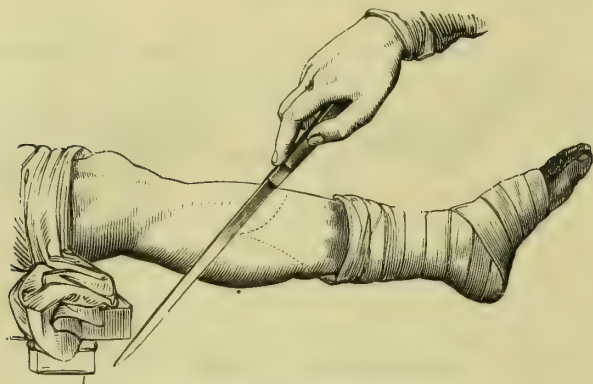
Amputation of the leg at its superior extremity should never be performed above the tubercle of the fibula, or above the attachments of the hamstring muscles, which are necessary to control the movements of the stump. In general, the stump should be at least three inches in length, otherwise it will hardly be able to subserve any useful pur-



Stump after amputation of the lower part of the leg.

pose, and it would be better, in such a case, to remove the limb at the knee. Two flaps are formed in this operation; one, which is entirely subcutaneous, in front, by cutting from without inwards, and the other behind, at the expense of the muscles of the calf, by cutting from within outwards (fig. 614). The latter should not be less than

Fig. 614.



Amputation of the leg.

four inches in length, and, in very robust subjects, may even require to be longer. The anterior flap is formed by making a semilunar incision across the front of the limb, from the inner edge of the tibia to the outer edge of the fibula; it is detached by a few strokes of the knife, and held up by an assistant. The instrument is then inserted at the external angle of the preceding cut, and brought out at the corresponding point of the opposite side, care being taken, in performing this part of the operation, not to thrust the extremity of the knife between the two bones; an occurrence which always betrays haste and embarrassment, if not actual want of anatomical knowledge. Transfixion being effected, the knife is drawn rapidly downwards, in close contact with the posterior surface of the bones, for the distance of several inches, when it is made to cut its way out, in order to give the flap its proper degree of convexity. As soon as this has been accomplished, the flap is retracted by the assistant, the interosseous structures are divided at the requisite height, and the two bones are sawn in such a manner as to sever the fibula before the tibia. The principal arteries will next claim attention, and it will generally be found that three—the anterior and posterior tibial, and interosseous—will require to be tied. When the amputation is performed uncommonly high up, the popliteal may be the only vessel demanding ligation, especially if it happen to extend unusually low down before it separates into its terminal branches. The interosseous artery is sometimes found with difficulty, owing to the fact that the tissues in which it is embraced are cut beyond the level of the flaps.

The principal arteries having been secured, the next step of the operation is to retrench the posterior flap by shaving off its redundant muscular substance, so as to adapt it more smoothly and accurately to



the exposed bones. I consider this procedure as one of paramount importance to the obtainment of a good stump, and it is one which I adopted many years ago before I was aware that it had been practised by any one else. I rarely allow the flap to be more than half an inch in thickness. Any considerable nervous trunk that may exist in the flap is now divided on a level with the bones, and the operation is completed by sawing off the anterior edge of the tibia, lest, if permitted to remain, it should interfere with the healing of the wound, or, in time, cause so much pressure as to induce ulceration in the cicatrice.

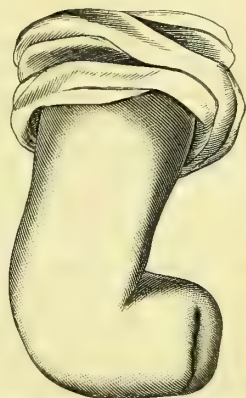
The appearances of the stump, made after the above fashion, are represented in fig. 615, from one of my patients.

Amputation at the middle of the leg is performed in the same manner as at the superior extremity, and does not, therefore, require any special notice. It is proper, however, to add that a very good stump may be formed by taking the flaps from the sides, as in the lower operation, although I have always preferred the other method.

#### AMPUTATION AT THE KNEE.

Amputation at the knee-joint was performed by Fabricius Hildanus in 1581. In modern times it is said to have been first executed by Hoin, and, although his example was soon after followed by several of his cotemporaries, yet the operation gradually fell into neglect, chiefly, as it would appear, because of the timidity of surgeons to penetrate into the large articulations. An attempt to revive the procedure, accompanied by a report of a number of successful cases, was made by Mons. Velpeau in 1830, but with so little effect that the subject was again forgotten, and the operation proscribed from our systematic treatises, until a few years ago. Since then much has been urged in commendation of it, and, if we may judge from the cases that have occurred in the hands of American and European surgeons, it is reasonable to infer that it will soon come into general favor. The statistics of the operation are still too limited to enable us to form a full and correct appreciation respecting its value, but these will doubtless be soon furnished, and we shall then be able to give a final decision. Meanwhile, it may be stated that, of 46 cases referred to by Dr. Thomas M. Markoe, in an article on amputation of the knee-joint in the *New York Journal of Medicine and Surgery* for January, 1856, 29 were successful and 17 fatal, thus showing a mortality of 37 per cent. Of these cases, 18 occurred in the practice of this country, chiefly in that of the New York surgeons, with only 5 deaths. The first amputation of this kind, in America, was performed in 1824, by

Fig. 615.



Stump after amputation of the upper part of the leg.

the late Professor Nathan Smith, of New Haven, the patient recovering without an untoward symptom.

If we compare the results of these operations with those of amputation of the thigh, it will be found, contrary to what might have been anticipated, and what, at first sight, very few would believe, that they are in favor of the former  $6\frac{1}{2}$  per cent. Thus, in the 46 cases of amputation at the knee there were 17 deaths, or a percentage of 37, while in 1055 cases of amputation of the thigh, performed by European and American surgeons, there were 464 deaths, or a percentage of  $43\frac{1}{2}$ .

The reasons which may be alleged in favor of this operation are, first, that the stump being longer than in amputation of the thigh, in its continuity, is more under the control of the patient, and, consequently, better able to bear the weight of the body upon an artificial limb, thus permitting progression without the aid of crutches; secondly, that, as there is no retraction of the muscles, there is less risk of exposure and exfoliation of the bone; thirdly, that the liability to pyemia is generally diminished from the fact that there is no injury inflicted upon the medullary canal; fourthly, that the wound is less than in the removal of the limb in its continuity; and finally, that the statistics of the operation, as furnished by Markoe, Stephen Smith, and others, display a smaller degree of mortality than amputation of the thigh. It need hardly be stated that disarticulation of the knee should never, as a matter of choice, be performed in preference to amputation of the leg in its continuity; such a procedure, involving more risk to life than the other, would not be justifiable; for, as remarked elsewhere, the nearer we approach the lower part of the trunk with the knife the greater is the mortality from its effects.

There are two principal methods of performing this amputation, the relative merits of which have not yet been fairly determined by statistical facts. The one consists in making a long flap in front, the other in making it behind, at the expense chiefly of the gastrocnemius muscle. Both operations are sufficiently easy, but when the surgeon has his choice he will be able, I think, to effect a more rapid cure, as well as make a better stump, by adopting the former method; in either case, the healing process will be facilitated by sawing off the ends of the condyles.

In the anterior operation, as it may be called, the knife is carried across the forepart of the leg, at least two inches and a half below the head of the tibia, in a semilunar direction, from the anterior margin of one hamstring muscle to that of the other; the flap is then carefully raised, the ligament of the patella divided, the disarticulation effected from before backwards, and the posterior short flap formed from the superior extremity of the gastrocnemius muscle, care being taken to preserve as much of the skin as possible. The patella being retained in this operation serves to fill up the gap between the two condyles, and thus add to the rotundity of the stump. Another advantage is that the line of the wound, after the approximation of the flaps, is brought into a more dependent position, thus admitting of the more ready exit of the discharges.

In the posterior process, the principal covering of the bone is obtained

from the muscles of the calf of the leg. The operation is commenced by drawing the knife across the centre of the patella, from one side to the other, the articulation being fully opened at the first incision. The integument is then dissected off from the patella, as high up as the superior extremity of this bone, which is then liberated from its tendon, and left adherent to the tibia. Introducing now the knife into the joint, the connecting structures are rapidly severed, and the main flap formed by carrying the instrument downwards, to a suitable distance, behind the bones. The operation is completed by removing the condyles of the femur, the saw being held in such a manner as to separate a larger portion of the inner than of the outer of these prominences, so as to give the stump a perfectly horizontal direction.

After each of these operations the popliteal artery will, of course, require to be tied, and, in general, also several of its branches. In that by the posterior method, the ends of the ligatures, which are usually placed close together, ought to be brought out through a small aperture in the centre of the long flap; a circumstance which will greatly expedite the adhesive process. The flaps should be stitched with the utmost nicety, and be well supported by plaster and bandage. The great fault apt to be committed in both these operations is that there is usually too little integument left for covering the bone, the consequence of which is that the wound is long in healing, and that the stump can never be well adapted to an artificial limb.

#### AMPUTATION OF THE THIGH.

The thigh may be removed in any portion of its length; at its inferior-third, at its middle, at its superior-third, or at the hip-joint, according to the particular exigencies demanding the operation. The great general rule, mentioned elsewhere, of leaving as long a lever, in all cases, as possible, is still more applicable here than in the leg and arm; experience having shown that it is extremely difficult to adapt a short stump of the thigh to an artificial limb, especially when, as not unfrequently happens, it is at the same time very bulky. The operation which I have always performed, and which, in my judgment, is decidedly the best, is that by flaps, taken from the anterior and posterior parts of the thigh. I have seen enough of the circular method to satisfy me that it is, as a general rule, even when well executed, seriously objectionable, on the ground that it seldom affords an adequate covering for the stump. Hence it is so often followed by exfoliation of the bone, tedious suppuration, and ulceration of the integuments. From all these mishaps the flap amputation is almost entirely exempt. I will not deny that I have not occasionally witnessed admirable results from the circular operation, but that it is more liable to be followed by accidents and by future inconvenience and suffering is unquestionable, and it is for these reasons, and not because it involves any particular difficulty or skill in its execution, that it should give place to the flap method.

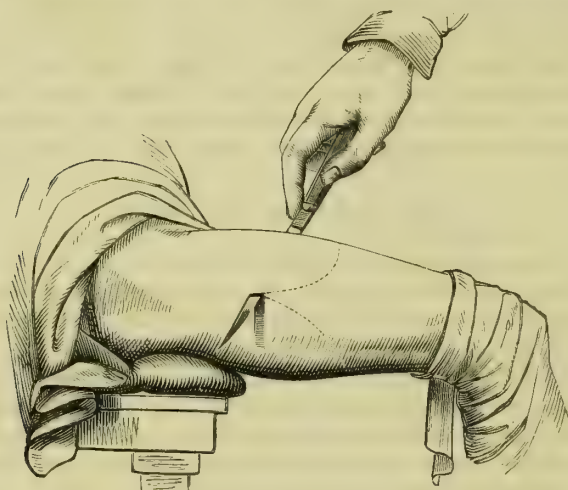
Although the operation by the antero-posterior flap usually furnishes the best result, from the circumstance that there is less liability to



retraction, yet a very excellent stump may be made by taking the covering from the sides of the limb, or even by dividing the parts obliquely. The fact is, the surgeon has often no choice in the matter, such being the nature of the disease or injury demanding the operation. In a case of horrible deformity and ulceration of the leg, from the effects of a burn, followed by permanent ankylosis of the knee-joint, which came under my observation, many years ago, in a boy five years of age, I was obliged to depend entirely upon one flap taken from the posterior surface of the thigh, and the result could not possibly have been more satisfactory. Whenever circumstances require a departure from the ordinary rules of procedure, the educated surgeon will have no difficulty in adapting his skill to the exigencies of each particular case.

The lowest point at which amputation of the thigh can conveniently be performed is about four inches above the centre of the knee. The

Fig. 616.



Amputation of the thigh.

anterior flap should always be made first, as the posterior includes the femoral artery. The soft parts being forcibly raised with the thumb and fingers, applied to the opposite sides of the limb, the knife is entered about three inches above the superior extremity of the patella, and, transfixion being completed, is drawn downwards close along the anterior surface of the femur, cutting its way out at the point just mentioned. The flap being now carefully retracted, the instrument is re-introduced into the wound at its upper edge, behind the bone, so as to fashion the posterior flap, which should be somewhat longer than the anterior, otherwise there will be danger of insufficiency of covering. This flap is now also held back, when, the knife being passed rapidly round the bone, on a level with the retracted structures, so as to divide any muscular fibres that may have escaped it in the previous stages of the operation, the bone is sawn off in the usual

manner. The femoral artery with several of its branches will require ligation, and the principal nervous trunks should be retrenched before approximating the flaps.

The stump left by the flap operation, as here described, is a very pretty one, and could not possibly be more serviceable. The drawing (fig. 617) is from life.

The operation now described may occasionally be advantageously executed, according to Vermale's method, by lateral flaps, of which the outer one should always be formed first. The transfixion is effected at the same height of the limb as in the preceding case, that is, about three inches above the upper extremity of the patella, the knife being inserted at the centre of the thigh in front, and pushed out at a corresponding point in the ham, whence it is carried downwards and outwards nearly as far as the external condyle. The inner flap is formed in the same manner, except that the instrument is kept in closer contact with the bone, lest the femoral artery be split. In other respects, the operation is to be conducted in the same manner as in the antero-posterior flap procedure.



Fig. 617.

Stump after amputation of the thigh.

In the middle and upper third of the thigh the method by anterior and posterior flaps deserves a decided preference over that by lateral flaps. The great advantages which it possesses over the latter are that the muscles are more evenly divided, and that, consequently, there is greater probability of obtaining a smooth and useful stump for sustaining the weight of the body upon an artificial limb. The different steps of the operation are similar to those which characterize amputation in the lower third of the thigh, and hence there is no necessity whatever for any formal description of it, as they will be readily comprehended by what precedes.

Amputation of the thigh by the rectangular method of Mr. Teale, is described at page 628 of the first volume, and does not, therefore, require any special notice here.

#### AMPUTATION AT THE HIP.

Amputation at the hip-joint may become necessary both on account of disease and accident; but the operation is so formidable a one, and so fraught with danger, that it should never be performed unless the patient has no other chance of escape. The great risk which attends

it is due to the loss of blood, suppuration, and pyemia. The hemorrhage, however, will not, in any case, be likely to be profuse, if proper care be taken to compress the arteries during the formation of the flaps, and if the operation be performed, as it always should be, in twenty-five or thirty seconds, good and trustworthy assistants being at hand to anticipate the surgeon's wishes and facilitate his movements. Under highly favorable circumstances much of the enormous wound may unite by the first intention; but, in general, more or less suppuration takes place, and in some instances the discharge is so copious as to lead to fatal exhaustion. The greatest danger of all, however, is the occurrence of pyemia, or secondary abscess, especially in amputation at the hip-joint in consequence of injury, as a compound fracture, or a gunshot wound. The shock of the operation must formerly have been very violent, and been of itself often sufficient to cause death within a short time after its performance; now, however, that we can avail ourselves of the use of anæsthetic agents, no special risk is to be apprehended from that source.

From the various statistics of amputation that have appeared from time to time, it may be inferred that the results are, as a general rule, much more favorable when the operation is done for the removal of disease than for the relief of accident; depending, probably, upon the fact that, in the former case, the system is more inured to suffering, and, consequently, more tolerant of the effects of the operation, while, in the other, the change is too sudden and severe to enable it to bear up under its exhausting influence.

Mr. Erichsen, availing himself of the labors of Dr. Stephen Smith, of New York, and also of those of other writers, has given the results of 126 cases of this operation, of which 76 proved fatal. Of 47 cases in which it was performed for injuries, 35 died. According to Mr. Macleod, of the ten cases that occurred in the Crimea, not one recovered. A successful case of amputation of the hip-joint has recently been reported by Dr. J. M. Warren, as the first of the kind that has ever taken place in Boston. It was performed on account of osteosarcoma of the femur, the patient being a lad sixteen years of age.

This operation, for a long time regarded as impracticable, and until lately alternately praised and censured, was first practised by Lacroix, in the case of a child, fourteen years of age, laboring under gangrene from the use of ergot. It may be performed in a great variety of ways, with two of which the surgeon should be familiar, as the circumstances of the case may leave him no opportunity for choice. These are the lateral and the antero-posterior flap methods, of which the first deserves a decided preference, from the fact that it admits of more ready drainage during the healing of the stump.

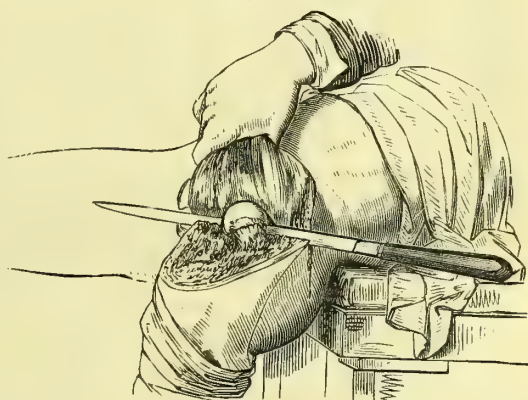
In the lateral amputation the external incisions should always be made first, though this is not so important when there are skilful assistants, of whom there should be at least four; one for administering chloroform, two for retracting the flaps and compressing the arteries, and one for holding the limb. If these matters be properly attended to, the operation is a comparatively easy one, and may often be executed in an almost incredibly short time, and with the loss of hardly



a few ounces of blood. The buttock being brought well over the edge of the table, the thigh pretty widely separated and everted, and the femoral artery compressed over the brim of the pelvis, the knife, which should be upwards of a foot in length, is entered, supposing the operation is performed on the left limb, immediately below the tuberosity of the ischium, and made to issue at a point midway between the anterior superior spinous process of the ilium and the great trochanter. The external flap is now formed by cutting downwards and outwards, in close contact with the bone, for at least four inches, especially if the subject be at all muscular. An assistant is ready to seize and retract the flap the moment it is fashioned, as well as to compress the orifices of the bleeding vessels. Re-inserting the knife into the upper angle of the wound, it is rapidly pushed down, along the inner surface of the bone, so as to form a large flap in that direction, to compensate for the small one on the outside. The assistant having charge of the femoral artery in the groin, now grasps the divided vessel, at the same time lifting up the flap. The next step of the operation is the disarticulation, which is readily effected by opening the upper and inner part of the joint, and then swiftly carrying the knife round the head of the bone, previously rendered prominent by depressing the knee. The arteries are now secured, first the femoral, and successively any others that may require the ligature, the assistants maintaining the compression until each vessel is ready to be tied.

The antero-posterior amputation at the hip-joint (fig. 618) is to be conducted upon the same general principles as the lateral, the only difference being the manner in which the flaps are made. Great care must also be taken

Fig. 618.



Amputation at the hip-joint.

to hold the scrotum out of the way. It will be most convenient to make the anterior flap first; this, when the operation is performed on the left side, is done by entering the knife on the outside of the hip, midway between the anterior superior spinous process of the ilium and the great trochanter, carrying it across the neck of the femur, and pushing it out at the centre of the thigh, immediately below the pelvis. The flap, which should be about four inches in length, is then formed in the usual manner; the joint is opened at its upper and inner part, as in the preceding case; and the disarticulation being effected, the posterior flap is fashioned by cutting along the back part of the bone.

The appearances of the stump and the line of the cicatrice, in the

antero posterior operation, are well displayed in the annexed sketch (fig. 619), from a daguerreotype kindly sent to me by Professor J. F.

Fig. 619.



Stump after amputation at the hip-joint.

May, of Washington City. His patient, who was forty years of age, had been laboring under caries of the head, neck, and shaft of the thigh-bone, attended with great enlargement of the limb. The operation was performed within thirty seconds, with a loss of blood hardly amounting to eight ounces. A rapid and complete recovery followed. The likeness here represented was taken nearly two years and a half after the operation.

After both of these operations, during the first four or five hours, the flaps should be supported simply by a few adhesive strips, and kept constantly wet with cold water. At the end of this time, when all oozing will probably have ceased, they should be approximated by numerous points of the interrupted suture, plaster, and bandage, care being taken to interpose a small tent at the inferior angle of the wound, for the purposes of drainage, which must always necessarily be considerable after such an extensive operation. When the patient is very robust, I should regard it as good practice to remove a large portion of the muscular mass composing the internal flap, under the conviction that the procedure, by insuring the more rapid healing of the huge wound, would greatly diminish the risk of pyemia and other accidents.

## CHAPTER XX.

## AFFECTIONS OF THE EXTREMITIES.

## 1. SUPERIOR EXTREMITY.

## MALFORMATIONS AND DEFORMITIES.

THE hand and fingers afford frequent opportunities for surgical interference, on account of deformities which not only greatly mar their beauty and symmetry, but seriously impede the exercise of their functions. These defects may be either congenital or acquired, being the result of various kinds of diseases and accidents, particularly paralysis and burns. The principal malformations met with here are, a deficiency or redundancy of parts, a webbed condition of the fingers, and organic contraction of the muscles and palmar aponeurosis, constituting a species of distortion analogous to club-foot.

A deficiency in the number and size of the fingers is occasionally observed, one or two being sometimes entirely wanting, or they are so stunted as to give the hand a very singular, unseemly appearance. In a case recently at my clinic, the fingers were all very short and stumpy, each being deficient in a phalanx. They were connected together by thick webs, smooth on the palmar surface, but rough and grooved on the dorsal, and were provided each with an excellent, well-shaped nail. The thumb was small, but natural, and had no membranous attachment to the index-finger. The person, who was a member of the profession, enjoyed a very good use of the limb.

In some cases there are only two fingers with the thumb; and not long ago I saw an instance where there was but one. The members, under such circumstances, may be of the natural shape and size, or they may be variously changed in their appearance, being generally thick and clumsy, or more or less contracted and stumpy. Occasionally they have a bulbous, knotty look, as if the umbilical cord had been twisted around them, and thus interrupted their natural growth. The thumb, I believe, is rarely affected in these mishaps to the fingers.

A supernumerary finger is uncommon, while it is by no means rare to see an additional thumb. Such a freak is occasionally met with on both sides, and there are some curious cases on record where each hand had a supernumerary thumb, and each foot a supernumerary toe, the individuals being, in other respects, perfectly well formed. Some of these cases have been hereditary. When an additional finger exists, it usually occurs in connection with the little finger.

The supernumerary member is generally a good deal smaller than the normal one, but well-shaped, and furnished with an excellent nail.



Occasionally it is bulbous, knobby, curved, and quite unseemly. Its attachment may be purely cutaneous, but in most cases it will be found to be through the medium of a separate joint, having a distinct synovial membrane.

A deficiency of fingers is, of course, an irremediable affection. If the person belongs to the higher ranks of society, something may be done to supply it by the adaptation of artificial fingers, secured to a glove, which, when worn, as it readily may be in company, shall hide the defect.

Any supernumerary piece that may exist is readily taken away by a very simple operation, care being taken to leave a sufficiency of integument to cover the wound, and to remove the part close to its attachment. I have seen two cases where a portion of the proximal phalanx being left, an unseemly projection remained, not at all creditable to the skill of the surgeon. The operation may be done within a few weeks after birth; if neglected until the person attains the age of manhood, he will be very apt to grow indifferent about it.

A webbed condition of the fingers is easily remedied by passing a bistoury vertically from below upwards, through the redundant fold, and after removing what is superfluous, tacking the edges of the wound together by several points of the interrupted suture, or allowing it to heal by the granulating process. The fingers are afterwards supported upon a carved splint, lint, spread with simple cerate, being interposed between them, to prevent the parts from re-adhering.

Permanent contraction of the thumb and fingers from rheumatism, burns, paralysis, and other causes, is not uncommon, and is liable to be attended with the most distressing deformity and inconvenience.

Fig. 620.



Such a condition is sometimes the result of a congenital vice, as in the annexed drawing (fig. 620), from a clinical case. The distortion may exist in various degrees, and may be occasioned simply by a contraction of the tendons, of the palmar aponeurosis, or of a diseased cicatrice, or all these structures may be involved simultaneously, as is, perhaps, in fact, most generally the case. The inodular tissue left by burns and scalds has, as is well known, an astonishing contractile tendency, which often resists the most ingenious efforts of the surgeon to overcome it, and which, in time, is capable of producing the most horrible deformity, the fingers being bent like claws, deeply embedded in the substance of the

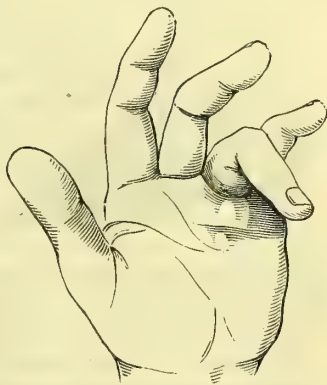
hand, or firmly united to one another. In paralysis, the fingers are frequently permanently flexed, in consequence of the shortened condition of the tendons of the flexor muscles, while the extensors are elongated, and completely deprived of their functions.

The immediate cause of these contractions, or the structures on which they directly depend, can only be determined by a careful exami-

nation, and the result must, of course, govern the treatment. The shortening occasioned by rheumatism, if existing in a high degree, will hardly be amenable to any remediable measures, however judiciously employed; it is only in the milder and more recent cases that much benefit need be looked for. The use of colchicum, assisted by calomel and opium, and the application of iodine and anodyne liniments, are the means chiefly to be relied upon. When the disease has been deprived of its acuity, an attempt may be made to break up the adhesions within the joints, and to restore the contracted muscles to their proper length, by gentle flexion and extension, or passive motion, the cold douche, and sorbefacient lotions, together with the splint and bandage, to maintain the hand constantly in a straight position.

When the deformity is dependent upon permanent shortening of the muscles, or tendons, as in fig. 621, however induced, tenotomy is of questionable propriety, all experience showing that, although the operation may relieve the distortion, yet the patient never regains any material use of the affected part; on the contrary, indeed, he is generally made worse by it. Hence the judicious surgeon should long hesitate before he undertakes a procedure likely to be followed by such a result. In particular should this be the case when all, or nearly all, the fingers are involved; for it has happened under such circumstances that what little use of the hand the poor patient still possessed was entirely destroyed by the division of the tendons, their ends refusing to unite. When only one finger is concerned, and the object is to relieve an ugly and inconvenient deformity, no objection whatever can be urged against the operation.

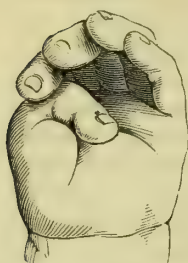
Fig. 621.



It will thus be seen that there is a remarkable difference between tenotomy of the hand and fingers and tenotomy of the feet. In the latter, the ends of the divided tendons always unite with great promptness, so that the patient, if the case be well managed, is sure in time to acquire a good use of his extremity; in the hand, fingers, and forearm, on the contrary, there is rarely, if ever, any perfect reunion, and the consequence is that the operation, so far as the functions of the limb are concerned, is a complete failure. The cause of this difference seems to be the existence of a larger amount of synovial fluid in the sheaths of the tendons of the superior extremity than in those of the inferior, and the greater amount of space which intervenes between these structures, when divided, in the former than in the latter of these situations.

When the deformity is dependent upon the contraction of the palmar aponeurosis, as in fig. 622, it may, in general, be readily rec-

Fig. 622.



tified by the free division of the resisting parts by a subcutaneous operation with a delicate, sharp-pointed tenotome. The aponeurosis may, if necessary, be cut completely across where it covers in the palm, and any of its digital slips that may seem to be at fault may then be successively traced out and severed. The after-treatment demands great attention. The hand and fingers must be enveloped in a bandage, and then carefully bound upon a well-padded, carved splint, frequent washing, friction, and passive motion not being neglected.

Deformity of the hand and fingers arising from the vicious cicatrices of burns and scalds (fig. 623), seldom admits of satisfactory relief. When the inodular tissue presents itself in the form of narrow bridles, it may be completely excised, and the

Fig. 623.



wound approximated by suture; or the bands may be cut across at different points, and the gaps healed by granulation, the limb being maintained in the extended posture during the cicatrizing process, as well as for some time after, in order to prevent a recurrence of the contraction. When the cicatrice involves a large surface, nothing short of its entire re-

moval, and the transplantation of a flap of healthy integument will be likely to answer any useful purpose. The graft might be borrowed from the other arm, or from the chest, as might seem most feasible.

The hand is sometimes distorted in such a manner as to present an appearance analogous to club-foot, especially the variety called varus. Hence it is generally termed *club-hand* (fig. 624). The affection is

Fig. 624.



occasionally congenital, but in the great majority of cases it supervenes in consequence of paralysis, or a loss of antagonism in the two classes of muscles. The alterations are characteristic. The hand is inverted, the external margin inclining strongly upwards, the fingers are more or less flexed, and the carpus seems to be partially dislocated from the radius and ulna, forming a marked projection at the inner border of the limb. Sometimes the hand is turned in the opposite direction, in imitation, as it were, of valgus, or the everted variety of club-foot. However this may be, the affection is not unfrequently associated with distortion of other parts of the body, and usually occurs in persons of a debilitated frame, or in such as are particularly prone to suffer from nervous diseases. Very recently, I saw a case in



which both hands and both feet were clubbed, the patient being a child three months old.

The *treatment* consists in attention to the removal of the exciting cause, and the improvement of the general health. To accomplish the latter, a course of chalybeate tonics, exercise in the open air, and the daily use of the cold shower bath, will be the best means. Electric currents may occasionally be passed through the affected limb, and the surface may be frequently rubbed with some stimulating lotion. If the case be recent, and the deformity comparatively slight, forced extension, repeated several times a day, and long-continued, will sometimes effect a cure. When this fails, an attempt may be made at rectification by the employment of appropriate apparatus, similar to what is used in the milder forms of club-foot; but, under opposite circumstances, division of the affected tendons alone will enable us to relieve the distortion, although a long time will elapse before there will be much improvement of the functions of the parts. The muscles whose section will generally be necessary are the long palmar, the flexors of the radius and ulna, and the superficial flexor of the fingers, the knife being introduced with the greatest caution, lest injury be inflicted upon the arteries and nerves of the forearm.

Serious difficulty is sometimes encountered in removing *rings* from the fingers, either in consequence of tumefaction caused by their pressure, or of the increased size of the member, as when the ring, put on early in life, has not been taken off for a long time. Most generally, however, it arises from a small ring being forced upon a disproportionally large finger. If relief be not promptly afforded severe inflammation will ensue, terminating in ulceration and perhaps in gangrene. Several methods may be adopted for effecting this object. In the first place, the hand may be immersed in ice-water, to cause contraction of the finger; or the finger may be tightly bandaged, and then held in ice-water. If these expedients fail, a piece of pack thread, or saddler's silk, well waxed, should be closely and firmly wrapt round the finger, beginning at the distal extremity, and extending as high up as the ring. The thread is then passed by means of a small blunt bodkin under the ring, when, drawing it very tightly, the ring is gradually forced down as the ligature is untwisted. Should this plan also prove fruitless, the only other resource is to cut the ring in two with a file, or a delicate pair of bone-nippers.

The elbow-joint is sometimes rendered useless by the contraction of the brachial aponeurosis and the tendon of the two-headed flexor, in consequence of paralysis, rheumatism, or burns. The proper remedy consists in the division of the affected parts, the operation being performed in such a manner as not to interfere with the brachial artery, and extension being afterwards made with an angular splint, united by hinges, and worked by a screw. In this manner, the limb may often be restored to usefulness in a very short time, especially when there is no serious disease of the joint.

Injury and rheumatism of the shoulder-joint are sometimes followed by contraction of the soft parts in its vicinity, seriously interfering with the restoration of its functions. Passive motion will do much

for such cases, and the knife can only be required when there is marked shortening of the pectoral muscle, pinioning the arm to the side. In making the section of the muscle, regard must be had to the safety of the axillary vessels and nerves.

#### WHITLOW.

This disease, technically called paronychia, and vulgarly felon, is an affection of the thumb or finger, commencing in inflammation, which soon terminates in suppuration, and sometimes even in gangrene. It is distinguished by the great severity of its pain, and exhibits itself under two varieties of form, the superficial and the deep, the former being limited to the skin and cellular substance, whereas the latter involves not only these structures, but also the tendon, periosteum, and bone.

Whitlow is very rare in children, and I do not remember ever to have met with it in infants. It is most common between the ages of twenty and thirty-five, but is also sufficiently frequent in elderly persons, cases occasionally occurring after the eightieth year. Females are more subject to it than men, and the probability is that certain occupations predispose to its development. Thus, washer-women, and other persons who have their hands habitually immersed in water, are particularly obnoxious to it. At times, the disease is epidemic, as happened a few years ago in various sections of the Union, and when an unusual number of cases, in both sexes, and of different ages, fell under my observation and treatment. An affection similar to whitlow is occasionally met with in the toes.

In the superficial forms of whitlow, the inflammation is generally seated immediately around and beneath the nail, commencing either at the side of the finger, upon its dorsal surface, or at its extremity. Without much, if any swelling, the part is of a dusky reddish aspect, tender on pressure, and exquisitely painful, throbbing violently and incessantly, and causing more or less constitutional disorder. In from two to three days after these phenomena present themselves, matter is observed in the finger, lying just beneath the epidermis, which is elevated into yellowish vesicles around the side and back of the nail; in many cases, pus is also situated below the nail, especially at its posterior extremity; and sometimes, again, it is found chiefly, if not exclusively, in the cellular substance immediately beneath the true skin. The inflammation generally extends some distance up the finger, and occasionally even over a considerable portion of the hand, which may be a good deal swollen, stiff, and painful. Not unfrequently, a reddish line, indicating the course of an absorbent vessel, is seen running along the limb, as high up, perhaps, as the axilla.

In the deep-seated variety of whitlow, the inflammation involves all, or nearly all, the structures of the finger, and is frequently followed by the destruction of one or more of the phalanges. The pain is of extraordinary severity, depriving the patient of sleep for days and nights together; throbbing, tensive, and diffused, often extending as high up as the elbow and even to the shoulder; steady and persistent,

but greatly aggravated by depending position, and only subsiding with evacuation of the inflammatory deposits, or the death of the part. The swelling also is great, sometimes enormous, involving both finger, hand, and wrist; the skin is red and oedematous, having a puffy, erysipelatous aspect; and the whole limb is often stiff and useless. If the morbid action be not speedily checked, matter will form deep among the tissues, in the connecting cellular substance, within the sheaths of the tendons, and beneath the periosteum, and spreading in different directions, will cause extensive havoc, burrowing along the finger and hand as far up, perhaps, as the wrist and forearm. In neglected cases, gangrene occurs, followed by sloughing of the tendons, and exfoliation of the phalanges. The external characters of whitlow are well illustrated in fig. 625, while the effects which the disease often exerts upon the bones are displayed in fig. 626.

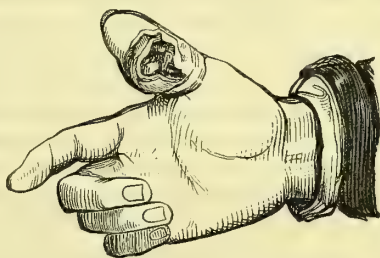
Whitlow, in its more severe forms, is always attended with well-marked constitutional disturbance. The patient, tortured with pain, is feverish, and unable to sleep; his appetite is gone; his head, back, and limbs ache; the face is flushed, and the pulse is strong, hard, and frequent. In some cases delirium is present.

How this disease is produced, or what its real character is, is still a mooted question. The most plausible conjecture is that it is a bad form of inflammation, not unlike carbuncle, occurring in a constitution more or less depraved, in consequence of a disordered state of some of the secretions, particularly those of the digestive apparatus. In the female, it is occasionally associated with irregularity of the menses, but whether as an effect or coincidence, we are unable to determine. My belief is that it is quite impossible for whitlow to occur in a constitution that is entirely sound. I should, therefore, infer that it is a peculiar form of inflammation, self-limited in respect to its tendency to terminate in suppuration.

I know of no disease with which paronychia is likely to be confounded. Its peculiar situation, the severity of the pain, the dusky appearance of the skin, and the speedy occurrence of suppuration, will always enable the practitioner to distinguish it readily from other affections. Boils and carbuncles never occur upon the extremity of the fingers.

In the *treatment* of this affection very little is to be expected from the employment of abortive measures, since, as has already been stated, its tendency is always to pass into suppuration. In its milder forms, and earlier stages, I have occasionally succeeded in limiting the morbid action by a brisk cathartic, and the application of the undiluted tinc-

Fig. 625.



Paronychia of the thumb.

Fig. 626.



Necrosis of the bones in whitlow.



ture of iodine, made two or three times in the twenty-four hours, with an emollient poultice, wet with laudanum, in the intervals; but, in general, the disease will go on, in spite of all that we can do, to the formation of matter. When the swelling is very considerable, leeches may sometimes be used advantageously in the vicinity of the focus of the inflammation, and in such instances I have also occasionally experienced great benefit from the application of a pretty large blister. To relieve the excessive pain, opiates must be given in full doses, and it will be well, also, for the patient to take, every three or four hours, a dose of the antimonial and saline mixture. It need hardly be added that the hand should be kept perfectly quiet, in an elevated position.

The above remedies are, however, at most, only palliative, relieving pain, and, perhaps, limiting morbid action, but not eradicating it; "scotching but not killing the disease." The great and indispensable agent of cure is the knife, employed early and boldly, not expectantly and timidly; the incision being long and deep, the edge of the instrument grating upon the bone. Suppuration is, if possible, anticipated, and so structure saved. When the matter has been permitted to burrow, numerous openings may be necessary, and extensive mischief take place, before we may be able to reach the point of repair, the fingers, hand, and wrist long remaining stiff, painful, and unserviceable. Dead bone is removed as soon as it is easily separable, the periosteum being as little interfered with as possible, and amputation always avoided, experience having shown that a new phalanx is sometimes formed, and that, even when this does not happen, the boneless finger will be both useful and sufficiently seemly. When the violence of the inflammation has subsided, the parts should be kept constantly wet with some anodyne and astringent lotion, alcohol and laudanum, or a solution of opium and hydrochlorate of ammonia. At a still later period, they should be well doused, first with warm, and then with cold water, dried, and rubbed with soap liniment, or camphorated mercurial ointment, and supported with a bandage, each finger being enveloped separately. These directions may seem trivial, but those who have ever had whitlow in their own persons, or who have seen much of the disease in others, will not fail to appreciate their value.

#### BANDAGES FOR THE FINGERS.

Bandaging of the fingers is a very nice operation; it is particularly called for in inflammation after fractures of the radius and ulna, and in cases of burns and scalds, with a view to the prevention of adhesions. The roller should be from three-quarters of an inch to an inch in width, and should be carried up, by circular and reversed turns, as far as the root of each member, when the extremity should be stretched across the back of the hand, which, when all the fingers are enveloped, should be surrounded with a broad bandage, extending from the knuckles a short distance beyond the wrist, as exhibited in fig. 627.

For retaining dressings on the hand, the bandage represented in fig. 628 is usually employed. It consists of a roller, an inch in

Fig. 627.

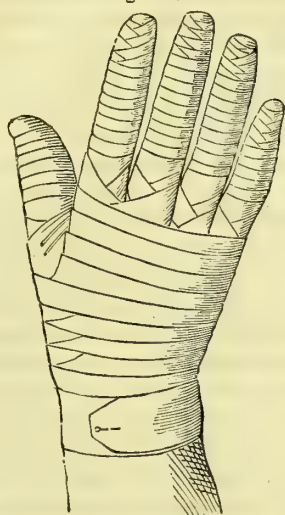
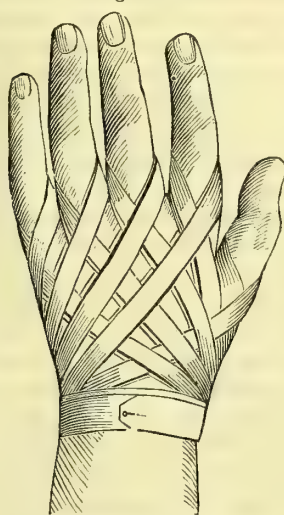


Fig. 628.



width, and several yards in length, carried, first, round the wrist, and afterwards across the carpus, in front and behind, in such a manner as to embrace the root of each finger.

## 2. INFERIOR EXTREMITY.

### MALFORMATIONS AND DEFORMITIES.

The affections that may be described under this head are the malformations and distortions known as club-foot and knock-knee, various deformities of the toes, arising from the wearing of tight shoes and other causes, and contractions of the tendons and aponeuroses in consequence of rheumatism, disease of the joints, paralysis, and other causes.

### CLUB-FOOT.

Club-foot consists in a peculiar distortion of the foot, attended with a deviation from its natural direction, and also, generally, with a diminution of its proper length. Presenting itself in various degrees, the deformity to which it gives rise is sometimes so great as to occasion the most disagreeable disfigurement and the most painful inconvenience, rendering the individual an object of constant attention and remark, as well as sadly interfering with the function of progression. Hence it is not surprising that it should always have attracted the notice and enlisted the sympathy of medical men, inducing them to investigate its nature and causes, and to devise means for its successful relief. For a long time, however, the whole subject was involved in almost impenetrable obscurity, notwithstanding the numerous attempts that had been made to elucidate it, and it was not until about thirty

years ago that anything like substantial light began to be shed upon it. Since that period the etiology, anatomy, and treatment of club-foot have received an extraordinary degree of attention, and it is perhaps not going too far to affirm that these topics are as well understood now as they probably ever will be. At all events, however this may be, it is perfectly certain that there is hardly a solitary case of club-foot, bad as it may be, that does not admit of complete relief, if attended to in time.

Club-foot is for the most part a congenital affection. It may, however, be developed after birth, and even at an advanced period of life, from the foot being accidentally placed in a constrained position, and so retained until the soft structures, particularly the muscles and ligaments, are moulded into a new shape, or thoroughly fixed in their new relations. Various mechanical causes may give rise to it, as splints and bandages, by which the parts to which they are applied are injuriously compressed, or forced out of their normal position. Similar effects are produced by convulsions, dentition, nervous irritation, contusions, sprains, fractures, partial luxations, and preternatural laxity of the ligaments. Sometimes the defect is occasioned by the presence of a corn, an ulcer, or some other disease which induces the person to walk on one side of the foot, the tip, or the heel, to ward off pressure from the tender parts. A vicious habit is thus established which, if continued for any length of time, as it frequently is, inevitably leads to irregular action of the muscles, and to distortion of the bones into which they are inserted.

The *etiology* of congenital club-foot has never been satisfactorily explained. The hypothesis of arrested development, so warmly advocated by some modern pathologists, is altogether untenable, being essentially contrary to the facts of the case in every particular. The imperfect growth, if any such really exist, is not congenital, as this doctrine teaches, but acquired, being the result of causes which are brought to bear upon the child during its intra-uterine life, leading to shortening and contraction of certain muscles, and not to a want of development, properly so called. It must be acknowledged, however, that instances occasionally do occur, although rarely, which strongly favor the doctrine under consideration. Thus, I have, in my own practice, seen two infants born at the full term, but who died immediately after birth, who had each well-marked hare-lip, cleft-palate, and club-foot, the result evidently, so far at least as we can judge of such an occurrence, of an arrest of development.

Another hypothesis of the formation of club-foot, that has met with considerable notoriety, is that the distortion is caused by the pressure of the uterus upon the feet of the infant during gestation, in consequence of a deficiency of the amniotic fluid. But, the question may be asked, if such an effect may be exerted by this organ upon the feet, why should it not be exerted also upon the hands, head, nose, chin, legs, and knees? Such a coincidence, supposing the doctrine to be true, ought to be of constant occurrence, yet it is so rare that it is probably not noticed once in a hundred cases of the affection. Besides,



it remains to be proved that women who bear club-footed children have always a deficiency of amniotic liquor.

The most plausible view, perhaps, that can be framed, in the present state of the science, of the formation of club-foot, is that it is produced by a defect of nervous influence, leading to a permanent contraction of certain muscles, with a corresponding retraction and incurvation of the bones into which these muscles are inserted. This hypothesis, for it is nothing else, derives corroboration from what occurs in strabismus, in which the straight muscles of the eye, frequently almost in an instant, simply from irritation, or an attack of convulsions, lose their parallelism, without the ability afterwards to regain it without an operation. Here the contraction of the muscles must be the direct result of a lesion of innervation, or perverted nervous action; for the effect is generally too rapid to justify the conclusion that it can possibly be due to inflammation, which has sometimes been invoked as its exciting cause. How a lesion of the nerves can be produced in the foetus in the womb is of course inexplicable; but that it does occur, in various forms and degrees, is a fact clearly established in pathology. It is worthy of remark, in connection with this hypothesis, and as strikingly confirmatory of it, that congenital club-foot has been repeatedly met with in the embryo as early as the third and fourth month. Moreover, it is not unfrequently associated with imperfect development of the cerebro-spinal axis, or of certain classes of nerves, and with an atrophied and contracted state of the muscles in different portions of the body, especially of the back, shoulder, and hand.

The congenital variety of club-foot often affects both feet, though rarely in an equal degree. The relative proportion, however, of double to single club-foot has not been determined; and the probability is, judging from recorded facts, that it varies materially in the practice of different surgeons. In my own hands the number of cases of single club-foot has considerably exceeded—perhaps in the proportion of three to two—the number of double cases. In one hundred and sixty-seven cases, reported by Dr. Detmold, of New York, the distortion occupied both feet in ninety-three. At the Orthopædic Hospital, London, the two affections are said to occur almost with equal frequency. When the distortion is single, it involves the right foot a little oftener than the left. Both sexes are liable to club-foot, but males suffer more frequently than females, probably, if I may judge from my examination of the subject, in the proportion nearly of two to one. Some very remarkable cases have been recorded of the occurrence of this distortion in different members of the same family. In one instance, observed by Held, all the children, six in number, were the subjects of congenital club-foot; and its history renders it probable that the affection was hereditary, since one of the parents was laboring under a similar infirmity. The transmissibility of this variety of deformity has been insisted upon by most writers on club-foot, and there are certainly just grounds for such an opinion; still, the occurrence is extremely uncommon.

Club-foot presents itself under several *varieties* of form, of which

there are four principal ones, differing from each other not only in regard to the character of the distortion and the accompanying phenomena, but likewise in relation to the frequency of their occurrence, and the nature of their treatment. These may be respectively denominated the inverted, everted, phalangeal, and calcaneal varieties of club-foot, each name having reference to the manner in which the limb touches the ground in standing or progression. Thus, in the inverted club-foot the inner margin of the foot is inclined upwards, while in the everted it is turned downwards; in the phalangeal variety the heel is elevated, and in the calcaneal it is depressed, the toes in the former case being, of course, turned down, and up in the latter. Besides these varieties there are several subdivisions, depending upon a combination of two of the principal forms, as, for instance, the inverted and phalangeal, which is extremely common, and the inverted and calcaneal, which is more rare.

The most common form of club-foot by far is the *inverted*, usually denominated *varus* (fig. 629), in which

Fig. 629.



Varus.

the patient walks upon the outer ankle, the great toe being directed inwards and upwards. The muscles of the calf and the adductors of the foot are contracted, and hence there is not only elevation of the heel, but a peculiar inward twist of the foot, analogous to supination of the hand. This alteration occasions the most serious impediment to progression, and when it reaches its highest point imparts a most disagreeable aspect to the affected limb. In the more severe grades of the disorder, the sole of the foot is literally scooped out, as it were, as well as deeply furrowed; the instep, on the contrary, is unusually convex and prominent; the small toes generally present in a vertical position, while the big one, separated

from the rest, looks upwards and inwards; the outer margin of the foot, which, in conjunction with the corresponding malleolus, chiefly sustains the weight of the body, is almost semicircular in its shape, rough, and callous; and the tendo-Achillis, forced obliquely towards the inner side of the leg, forms a tense, rigid cord beneath the skin.

When, as not unfrequently happens, both feet are affected with varus, their points may form an acute angle with the leg; or they may approach so nearly as to touch, and even overlap each other. In the majority of cases the thigh and leg retain their natural conformation, being merely somewhat atrophied; occasionally, however, the knees project slightly inwards or outwards, in consequence of the contraction of the hamstring muscles.

The second variety of this deformity, anciently called *valgus* (fig. 630), may be regarded as the opposite of varus, the patient treading on the internal margin of the foot, while the external is entirely re-

moved from the ground. The sole is directed outwards and slightly backwards, the toes are more or less elevated, and the outer ankle is in a state of semi-flexion. The heel is drawn upwards and somewhat outwards, the internal malleolus is uncommonly prominent, the instep is flatter than natural, and the muscles of the calf, together with the abductors of the foot, are permanently contracted. When the disease has attained its highest point, the patient has an unsteady, vacillating gait, from the difficulty which he experiences in preserving his centre of gravity. Valgus is comparatively

rare; like the first variety of the distortion, it may affect one or both limbs. It is seldom a congenital affection, but is almost always produced by some local injury, as a sprain, blow, or contusion. The most simple form of the affection constitutes what is called flat-foot.

The phalangeal variety of club-foot (fig. 631), the *pes equinus* of the older writers, is caused by a shortening of the gastrocnemial and soleal muscles, aided, in some cases, by the flexor of the toes. It is nearly always a non-congenital affection.

In this species of the deformity the individual walks upon the ball of the foot, the toes, or the metatarso-phalangeal articulations, without the heel or any other part of the sole touching the ground. The distance to which the heel is raised varies in different cases, from six lines to four or five inches, according to the extent of the contraction upon which the distortion depends. Considerable diversity is observed in regard to the manner in which the person treads on the ground; most commonly the ball of the little toe bears the brunt of the pressure, but in some instances the weight is thrown upon the great toe, or it is diffused over the whole of the forepart of the plantar surface. In the worst grades, the heel is so much elevated that the foot

forms nearly a straight line with the leg, the toes are much deformed, and perhaps retracted, if not doubled under, the instep is unnaturally convex, from the projection of the astragalus, the plantar aponeurosis

Fig. 630.



Valgus.

Fig. 631.



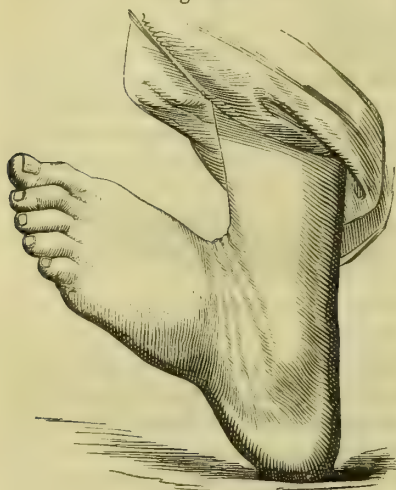
Equinus.



is greatly contracted, and the skin above the heel is thrown into large, dense wrinkles. Phalangeal club-foot, without any complication with the other forms of the affection, is exceedingly rare.

In the fourth variety, the *calcaneal* (fig. 632), the limb rests upon the heel, the toes being drawn upwards, towards the anterior sur-

Fig. 632.



Calcaneus.

face of the leg, with which they sometimes form an acute angle. The immediate cause of the deformity is a contraction of the anterior tibial muscle and of the extensor of the great toe, assisted occasionally by that of the common extensor of the foot. The tendons of these muscles form an evident protuberance under the skin, where they present the appearance of tense, rigid cords, which powerfully resist the flexion of the limb. The inner margin of the foot, as seen in the cut, is sensibly elevated above the outer, and there is always considerable atrophy of the leg. The distortion, which is almost always congenital, is exceedingly rare. I have seen only one case of the non-congenital variety. The pa-

tient was a young female, who, in consequence of an ulcer on one of the toes, had got in the habit of walking on her heel, until at length the parts became rigidly fixed in their abnormal position. Occasionally the foot inclines slightly outwards, owing to the inordinate contraction of the common extensor muscle.

The changes which the bones, ligaments, and muscles undergo, vary, not only in the different species of club-foot, but in the different stages of the same case. The greatest alteration appears to exist on the part of the tarsal bones, which, although they are rarely completely dislocated, are generally somewhat separated from each other, twisted round their axes, variously distorted, atrophied, or marked by irregular spicules or exostoses. The calcaneum, cuboid, scaphoid, and astragalus, always suffer more than the other bones; which, however, as well as those of the metatarsus and of the toes, usually participate, more or less, in the deformity. The ligaments, in recent cases of club-foot, do not present any material changes, but in those of long standing, or in the higher grades of the affection, they are invariably stretched in the direction of extension, and relaxed in that of flexion. In some instances the original structures are partially replaced by bands of new formation, of a dense, fibrous character, the volume and resistance of which vary according to the duration of the disease and the pressure of the parts which they serve to connect. The muscles also are not much altered in the first instance, except that they deviate from their natural direction, and that, like the ligaments, they are

elongated on the one hand, and shortened on the other. In ancient cases the whole limb is always considerably wasted, and many of the muscles are remarkably thin and pale, or even transformed into soft, fatty bundles. The cellular substance is condensed and diminished in quantity; the fat is absorbed; and even the vessels and nerves supplying the affected parts are reduced in volume. The skin of the foot, which receives the principal brunt of the pressure in standing and walking, is generally very much thickened and indurated, and large synovial bursae are often formed beneath it, which are apt to inflame, and thus add to the suffering of the patient.

The *treatment* of club-foot should always receive early and efficient attention, for the longer it is deferred the more difficult it will be, other things being equal, to effect a cure. This is equally true of the congenital as of the accidental form of the affection. The bones in early life, and in recent cases of deformity, are much more easily restored to their normal position than in youth and adolescence; and the muscles also regain much sooner, as well as more completely, their native power. In the worst grades of the lesion, it is generally extremely difficult, if not impossible, when treatment has been neglected until after the age of puberty, to make a satisfactory cure without the division of a great number of tendons, and the necessity of compelling the patient to wear, for a long time, various kinds of apparatus.

The precise period at which the treatment should be commenced has been variously defined by different authorities. Provided the infant is healthy, my custom has long been to begin it as early as the end of the second month, and unless the case is very bad, I have rarely found it necessary, at this early period, to do more than confine the limb in a well-adjusted apparatus, worn steadily day and night. If the distortion is considerable, I invariably employ the knife, as a preliminary measure, and this may always be done with the most perfect safety, even within the first four or five weeks.

Different kinds of apparatus are in vogue for the cure of club-foot, and it is, therefore, not always easy for the practitioner to determine which is the best, or which should be employed to the exclusion of the other. Every orthopædic surgeon almost has some peculiar notions upon the subject, which induce him to adopt such measures as whim, fancy, or experience may dictate. This very circumstance, however, goes to show that the same end may be attained by different means. Whatever plan be adopted, the great caution to be observed, on the part of the surgeon, is that the extension be made in a slow and gradual manner, that the skin be protected from friction and unequal pressure, that the dressing be worn day and night, and, finally, that the limb be frequently washed, and immediately afterwards rubbed with some mild sorbefacient lotion. The object of these instructions is self-evident, and must be constantly borne in mind in our curative procedures. During the first few days the apparatus should be applied rather loosely, until the limb has become accustomed to its presence, when it must be gradually tightened. If the skin becomes chafed, hot, and tender, measures must immediately be adopted to moderate, or shift the pressure, or the apparatus must be left off alto-

gether for a few days. In young children the integument is so delicate that, unless the greatest caution is used, the foot may be seriously injured before any one is aware of what is going on. By inattention to this rule, I have sometimes seen deep ulcers produced, which greatly interfered with the subsequent management of the case.

The time required for restoring the limb to its normal position must necessarily vary in different cases, and must depend upon so many circumstances as to render it impossible to lay down any specific rule. From two and a half to six months, however, may be regarded as a fair average, though occasionally a much longer period will elapse, and that too when the most unremitting attention is bestowed. The division of the faulty tendons generally materially expedites the cure, and should always be promptly resorted to the moment it is found that the case is likely to prove obstinate. Indeed, I am not sure whether it would not be well, in almost every case, however simple, to resort to tenotomy as a preliminary step.

In the milder forms of varus, or the inverted variety of club-foot, I have often succeeded in effecting complete cures, in a very short time, by the use of adhesive strips, aided by a long splint for the outer part of the leg, arranged on the plan of that of Dupuytren for fracture of the fibula. The strips should be from an inch to an inch and a quarter in width, and long enough to reach as high up as the knee, or even to the lower third of the thigh. Cut in the direction of the length of the cloth, they should be well stretched, to prevent their relaxation, when they should be applied so as to extend from the inner margin of the instep spirally or vertically up the limb, the foot being the while forcibly bent upon the leg by an assistant. Five or six strips will generally suffice, but occasionally I have found it necessary to employ as many as ten or twelve. They should be laid down as smoothly as possible, and be confined at suitable distances by cross slips, extending partially round the limb, otherwise they may embarrass the circulation. A narrow roller is next applied from the toes upwards. A broad cushion, filled with cotton, bran, or horse hair, and considerably thicker inferiorly than above, is now stretched along the outside of the limb, from the middle of the thigh to the ankle, and over this a tight splint, projecting from an inch and a half to two inches below the level of the sole of the foot. The dressing is completed by securing the apparatus with a bandage, passed round the instep and ankle in the form of the figure 8, and thence by circular and reversed turns up the limb.

This apparatus, which is exceedingly simple and easy of construction, causes, when carefully used, neither pain nor inconvenience. The strips should be renewed as often as they become slack, which will be about the sixth or seventh day, when the limb should be well washed, and rubbed with some gently stimulating lotion. When the child is not more than a few months old, or the distortion is inconsiderable, a cure may generally be effected in this way in ten or twelve weeks. As a preliminary step, I commonly divide the tendo-Achillis and also, if necessary, the plantar aponeurosis. When the apparatus is laid aside, the foot should be placed in a strong boot, made of un-



dressed sole-leather, carefully moulded to the limb, and constructed so as to lace in front in its whole length.

Although the contrivance here described will often answer extremely well, yet I would not, I must confess, advise its use when it is practicable to obtain a properly constructed club-foot apparatus. This can, of course, always be readily done in large towns and cities; but in remote situations cutlers are seldom to be found, and it is then that the surgeon is obliged to tax his ingenuity to provide means necessary for the accomplishment of his purpose.

Fig. 633.

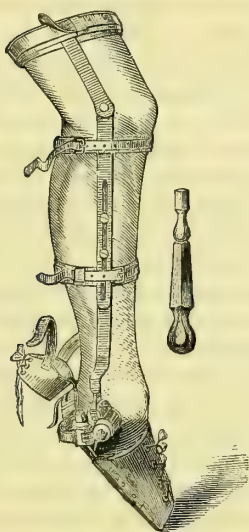
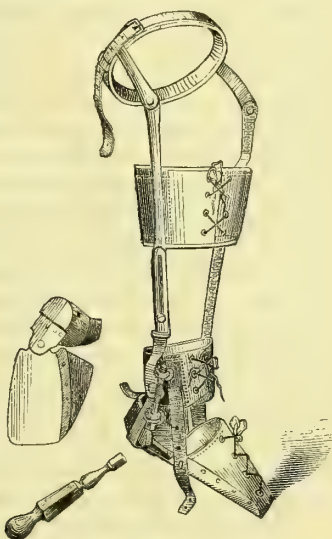


Fig. 634.



A great variety of club foot apparatus has been constructed during the last twenty-five years, all based upon the original shoe of Scarpa, so well known to surgeons. The adjoining sketches (figs. 633 and 634) afford a good idea of what such a contrivance ought to be, and, under the superintendence of that excellent cutler, Mr. Kolbé, of this city, it can be readily made with the aid simply of a plaster cast, which can now be sent from any part of the country by express. The essential elements of the apparatus are a shoe and two side-pieces, extending as high up as the lower third of the thigh, the whole being so arranged by means of screws as to permit the angle of flexion to be regulated at pleasure. The shoe, which is composed of soft leather, well padded, and laced in front, has a steel-sole, consisting of two pieces, moved by a concealed screw, the spring of which projects at the side. In this way the foot may readily be turned to one side or the other, according to the exigencies of the case, while it is depressed or elevated by an oblique screw at the ankle, connecting the shoe with the leg-piece of the apparatus, and worked by a key, as seen in the accompanying drawing. The steel rods which extend along the sides

of the limb are so constructed as that they can be lengthened or shortened at will, and are secured in their proper position by means of well-padded straps, each inclosing a semicircular piece of steel behind, in order to afford proper support to the limb in that situation. They are united, opposite the knee, by a hinge-joint, with a view of permitting the full play of that articulation.

There is an apparatus, differing from the preceding chiefly in having only one side-piece, and in being worked by an endless screw, as it is termed, situated opposite the ankle. Its great value consists in the facility which it affords for depressing the displaced margin of the foot.

The *division* of the faulty tendons requires more care and attention than is usually imagined. Every tyro in surgery thinks he can perform it; but this is a great mistake. To do it well requires skill, judgment, and a competent knowledge of the anatomy of the foot and leg. It is this presumptuous interference that has brought so much obloquy upon this operation in this country. In general, very little preliminary treatment is necessary; often, indeed, not any. If the child, however, is several years old, and has been accustomed to much exercise, it will be well to keep him at rest for a few days before the operation, to wash the foot repeatedly with cold water, and to enjoin a light diet. The operation may then be commenced, chloroform being given or not, according to circumstances, and every faulty muscle being divided at one sitting. The position of the patient must necessarily vary according to the exigencies of each particular case.

The number and nature of the tendons requiring division vary with the extent and character of the distortion. Thus, in simple equinus, or phalangeal club-foot, the tendo-Achillis alone being concerned in producing the affection, the operation must accordingly be restricted to that cord, and the effect is generally such that, if the patient is able to walk, no apparatus will afterwards be needed to bring down the heel. Pure, uncomplicated varus requires the division of the tendon of the anterior tibial muscle, or of this muscle and of the long flexor of the toes. In the more simple forms of valgus, the tendons of the peroneal muscles are mainly concerned; while in calcaneal club-foot the distortion depends upon the contraction of the anterior tibial and common extensor muscles of the toes. In equino-varus, and in the worse forms of club-foot generally, more or less extensive division of the plantar aponeurosis is required.

Age is no bar to tenotomy. I have repeatedly performed the operation within the first two months after birth, and I should not object to its performance, if the child were perfectly well, and the distortion very great, within the first fortnight, though, as a general rule, it is always best to wait a much longer time. Young adults are often immensely benefited, and sometimes entirely relieved by the operation; and cases have been reported of excellent results in persons of forty and even fifty years of age.

The knife which I am in the habit of using in tenotomy is represented in the adjoining sketch (fig. 635); it is nearly six inches in

length, of which one inch and three-quarters are occupied by the blade. The cutting portion of the blade is spear-shaped, very sharp, thin, and a little more than five-eighths of an inch in length by two-thirds of a line in width at its widest part. The instrument, of course, makes a mere puncture in the skin.

Fig. 635.



In dividing the *tendo-Achillis*, the patient is placed upon his abdomen, and the limb, extended upon the table, is firmly held by an assistant. The operator, sitting in a chair, then grasps the foot with his left hand, and bending it over the edge of the table, brings down the heel as far as possible. The necessary tension being thus given to the tendon, the knife is entered flatwise between it and the deep seated structures, a full inch above the calcaneum, and pushed on until it reaches the opposite side, care being taken that the point does not pierce the integument. The instrument is now turned in such a manner as to bring the edge of the blade against the anterior surface of the cord, which is then completely severed by pressing the handle steadily and firmly backwards, with a kind of sawing motion. The division of the parts is generally indicated by a distinct snap, and by the immediate cessation of their resistance. The operation, which is soon over, is attended with hardly any pain, and with the loss of only a few drops of blood. The only danger is the wounding of the posterior tibial artery, but this may be easily avoided simply by keeping the knife in close contact with the anterior surface of the tendon, and cutting from before backwards. The puncture may be made on the inner or on the outer side of the limb, as may be found most convenient.

The tendon of the *posterior tibial* muscle is cut most conveniently about an inch and a quarter above the inner ankle, the patient lying on his side, with the inner surface of the leg looking upwards. The operation is conducted upon the same principles as in dividing the *tendo-Achillis*, and the only precaution necessary is to avoid the posterior tibial artery and nerve, which might be endangered by carrying the knife too deeply. The tendon of the long flexor muscle may be severed at the same point. In the slighter cases of distortion, the tendon of the posterior tibial muscle may be cut below the ankle, in its passage to the scaphoid bone, but in the more aggravated forms such a procedure is impracticable on account of the concealed situation of the cord. The tendon of the flexor muscle of the great toe may be divided in the sole of the foot, where, when it interferes with the rectification of the limb, it will be found to form a tense, prominent cord.

The most favorable situation for dividing the tendon of the *anterior tibial* muscle is in front of the ankle-joint, where it may usually be easily felt, forming a tense cord, lying somewhat nearer to the internal malleolus than in the natural state. The patient rests on his back during the operation, and care is taken not to wound the anterior tibial artery.

The tendons of the *peroneal* muscles are most conveniently divided a



short distance above the outer ankle, as they run over the fibula. The operation will be facilitated if, as the knife is carried outwards towards the surface, the foot be rotated downwards and inwards, the cords being thus rendered more tense.

Section of the *plantar aponeurosis* is to be effected upon the same principles as that of the tendons, the knife being inserted flatwise beneath the skin, and made to cut from before backwards, the patient lying upon his back, and the foot being put on the stretch. As the aponeurosis is extremely dense and firm, its division generally requires a very sharp, well-tempered knife, worked with a kind of sawing motion, the finger resting the while on the skin immediately over it, to prevent it from cutting through. It is seldom necessary to divide more than two bands, one in the posterior part of the sole, and the other at the inner margin of the foot, corresponding with the metatarsal bone of the great toe.

All the faulty structures having been thoroughly divided, the foot is well flexed and extended, in order to break up any morbid adhesions that may exist, and separate as widely as possible the ends of the tendons, as much force being used for this purpose as may seem to be compatible with the safety of the limb. The advantage gained in this way is generally very great, and it is remarkable how tolerant the parts are of manipulation. The little puncture made in the operation is covered with a strip of adhesive plaster, and usually closes by the next morning. The limb being bandaged from the toes up, is immediately placed in the apparatus provided before the operation. This plan has been constantly pursued by me for many years, and I have never had any cause to regret it; on the contrary, I believe it to be decidedly preferable to waiting three or four days, as usually recommended by authors; for at the end of this time the parts are often so tender as to be quite intolerant of pressure and extension. It is only in cases of an extraordinary character that this rule should be deviated from. There need be no apprehension of a want of reunion of the ends of the divided tendon when this course is adopted. I have myself never seen such a case, nor heard of one that was entitled to credence. The apparatus must, of course, be applied rather loosely at first, and be gradually tightened as the limb becomes more tolerant of its presence. It should be taken off regularly every other day, in order that the limb may be well washed and rubbed with some mild sorbefacient lotion, as well as subjected to passive motion; a circumstance of great importance in respect to the welfare of the ankle-joint, and the restoration of the muscles of the limb. For the first five or six days after the operation, the limb is kept at rest in an elevated position; but after that time the patient may go about on his crutch or stick, as he may find it most convenient. The apparatus must be worn day and night, for a period varying from three to twelve months, according to the severity of the case. If the treatment be properly conducted, the patient and surgeon carefully co-operating, there will seldom be any necessity for a redivision of the tendons.

In simple equinus, occurring in childhood and young persons, I

have never found it necessary to apply any apparatus, the heel readily coming down under exercise, which the patient may safely begin within a few days after the operation.

The interval between the ends of the divided tendons is gradually filled up with plastic matter, while the blood poured out in the operation is rapidly removed by the absorbents, none of it being required for the repair of the breach. As in other subcutaneous procedures, so in this, the plasma soon becomes organized, and is finally converted into a firm, dense substance, analogous to the original structure, which it now replaces. Observation shows that it is already quite firm and unyielding by the end of the first fortnight; a circumstance which proves how important it is to give due heed to the management of the extending apparatus.

The operation for club-foot is occasionally attended with the puncture of some of the arteries, especially the anterior and posterior tibial. Should such an accident unfortunately occur, the proper plan is to cut the vessel completely across, and to apply a graduated compress to the wound.

Finally, whatever mode of treatment be adopted it is of paramount importance that it should be carried out under the personal superintendence of the surgeon; to delegate this office to the parent or nurse or to the patient himself, is only a waste of time, and what no sensible surgeon should ever do. I never, in fact, like to intrust the management of a case of club-foot even to an intelligent physician, for there are so many points about it that, unless the greatest possible care is exercised, something will be sure to go wrong, and mar the beauty of the cure.

The adjoining sketch (fig. 636), illustrates the effects of the division of the tendo-Achillis and plantar aponeurosis, in a case of equino-varus, attended with bad deformity. The cure was perfect.

Fig. 636.

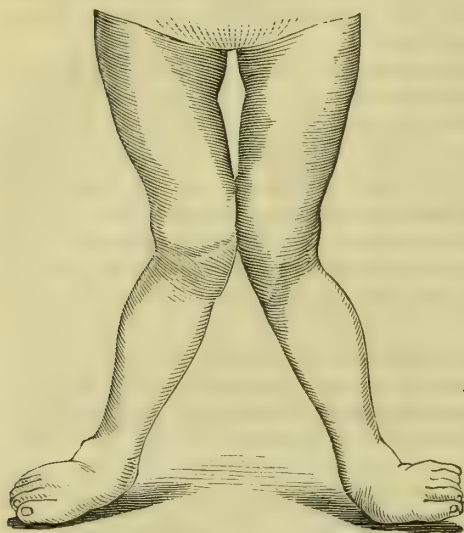


Exhibits the effect of the operation.

#### KNOCK-KNEE.

Knock-knee is an affection in which, as the name implies, the knee is turned inwards in such a manner as to touch its fellow of the opposite side, the leg being at the same time inclined outwards. When both knees are involved, and the deformity exists in a high degree, the lower extremities, when the individual stands up, represent pretty accurately the outline of the letter  $\Lambda$  inverted, the upper part corresponding to the thighs and the lower to the legs, as seen in the accompany-

Fig. 637.



ing cut. The feet are widely separated from each other, and are often so much everted as to compel the person to support the weight of his body principally upon the inner margin of the limb. The deformity thus occasioned is not only very unseemly, but, what is worse, produces a limping, awkward gait, which greatly interferes with progression.

Knock-knee is always a non-congenital affection, though it is occasionally noticed at so early a period of life as to have led to the opinion, at one time sufficiently common, but now obsolete, that it is now and then an intra-uterine lesion. It occurs chiefly in weakly,

delicate subjects, from the age of two years to that of eighteen or twenty. Children of a scrofulous habit and a rachitic predisposition are particularly obnoxious to it. So far as my observation enables me to judge, I am inclined to believe that the affection is considerably more frequent in males than in females, although some allowance must certainly be made for the fact that the difference in the clothing of the two sexes renders the former when laboring under knock-knee, a subject of much greater attraction than the latter, many of whom, simply in consequence of the petticoat, entirely escape detection both in the house and in our public thoroughfares. The worst cases of this affection that I have ever seen occurred in negroes.

The immediate *cause* of this affection is a relaxed and enfeebled state of the internal lateral ligament, which allows the external hamstring muscle, one of the flexors of the thigh, to drag the head of the tibia gradually outwards, away from the inner condyle. Whether the internal hamstring muscles, the semi-membranous and semi-tendinous, as they are termed, are originally involved in this partial displacement is not easily determined; but, however this may be, it is certain that they too become very soon relaxed and elongated, thus losing their antagonistic influence, and permitting their fellow on the opposite side to fall into a shortened and contracted condition, which, if not timeously remedied, only tends to a still further increase of deformity. The existence of this state of the parts has been verified by dissection, and may be readily ascertained by carefully examining a person laboring under knock-knee, in the recumbent posture. The limb being turned in various directions, an opportunity is afforded of determining where the structures at and around the knee are most relaxed and most resistant. In the more aggravated forms of the affection, the crucial ligaments always participate in these changes in the natural



relations of the parts; the bones of the leg are liable to be curved and otherwise altered, and the feet are either very much flattened, or more or less inverted, as in valgus. In such cases, the ankle-joint also usually becomes involved, the internal ligaments being attenuated and stretched, and the peroneal muscles more or less contracted.

The *treatment* of knock-knee, in its more simple forms, admits of relief by mechanical means, such as a long, hollow, and well-padded splint, applied along the inner surface of the thigh and leg, so as to counteract effectually the contraction of the outer hamstring muscle, which is the active agent in the displacement. The use of the apparatus should be assisted by a course of tonics, the shower-bath, and the cold douche, followed by stimulating lotions to the affected limb. In short, no pains should be spared to invigorate the general health, and impart tone to the nervous system, which are so frequently at fault under such circumstances. The apparatus must be worn for a long time, inasmuch as the tendency to relapse is always remarkably great in almost every case of the kind.

When the affection is obstinate, or exists in a high degree, the best plan is at once to divide the tendon of the two-headed flexor muscle; an operation which is not only very simple, but extremely valuable in furthering the cure. In performing the operation, the patient is placed upon his abdomen, when, the limb being slightly flexed, a delicate tenotome is entered flatwise at the outer margin of the tendon, from an inch to an inch and a half above the knee, and passed on until it reaches the opposite side, when, the cutting edge being directed forwards, the division is easily effected in the usual manner. No vessel is in danger of being injured, but the peroneal nerve is occasionally cut, followed by slight paralysis, which, however, seldom lasts longer than a few months. Should the femoral aponeurosis be involved in the contraction, any hard and resisting bands that may present themselves may now be severed by a cautious use of the knife. The little punctures made in the operation being covered with bits of adhesive plaster, the limb is wrapped in a bandage, from the toes up, and placed in an easy posture over a pillow; or, what I prefer, the extending apparatus may be applied at once, as the resulting inflammation is generally so slight as not to require any special attention.

#### DEFORMITIES OF THE TOES.

It is very seldom that we meet with congenital absence of the toes; supernumerary toes, on the contrary, are not very uncommon, the additional member being usually connected with the large toe, which it closely resembles in shape, but does not equal in bulk. The anomaly sometimes occurs on both feet, and cases are met with where it co-exists with an additional thumb. The supernumerary member is not only unseemly, but, by increasing the width of the foot, may seriously interfere with the patient's comfort and convenience. Hence, it should always be removed soon after birth. The operation is very simple, the only care required being to take away the whole of the anomalous

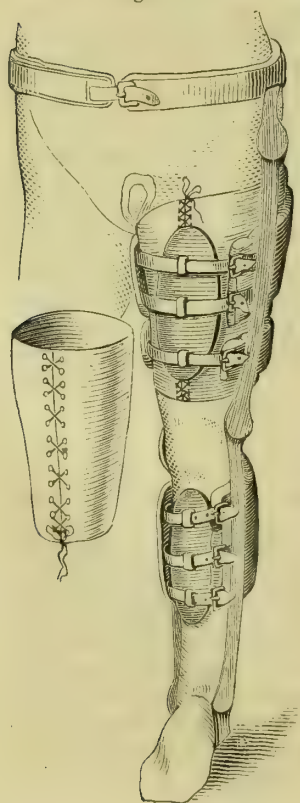
toe, and to leave a sufficient amount of integument to afford a good covering for the exposed surface.

Deformity of the toes occasionally arises from the effects of rheumatism, from paralysis, or from the wearing of a tight shoe, causing them to project in an unseemly and inconvenient manner, either above or below the natural level, or producing an incurvated, claw-like appearance. The immediate cause of the distortion is a contraction of the tendons of the flexor muscles, which should accordingly be divided, as they pass beneath the first phalanx, by subcutaneous section, the faulty toes being afterwards treated in the extended posture by splint and bandage, until they are completely straight. When the great toe is mainly involved, as generally happens when the affection is induced by paralysis, it may be necessary to divide the long flexor in the sole of the foot; but in doing this, proper care must be taken to keep the knife close to the affected tendon, made previously as tense as possible, otherwise the internal plantar artery might suffer.

#### DEFORMITY OF THE THIGH AND LEG.

The thigh is sometimes drawn remarkably inwards, in a very awkward and constrained position, by the permanent contraction of the short adductor and pectineal muscles.

Fig. 638.



Several cases of this kind have fallen under my observation, chiefly in young boys from five to eight years of age, without my having been able to trace the affection to any assignable cause, none of the subjects having suffered from rheumatism. The contraction sometimes exists simultaneously on both sides, and, under such circumstances, the person usually walks with great difficulty, the gait being very unseemly and crippled, the limbs during progression tending to cross each other. The remedy consists in dividing the faulty muscles freely by subcutaneous section, care being taken to keep the tenotome as closely as possible to the affected structures. The thighs should be forcibly abducted immediately after the operation, and in three or four days, the patient may be permitted to run about. The cure will be expedited by exercise on the hobby-horse, and by whatever has a tendency to keep the limbs apart.

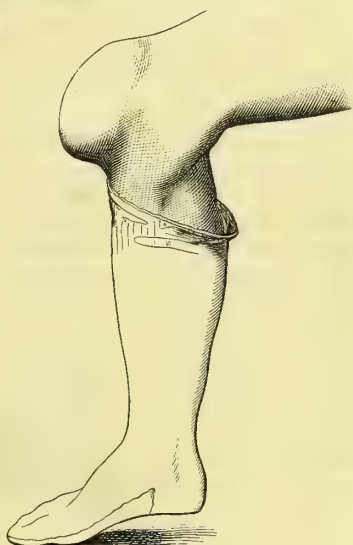
The hamstring muscles, on one or both sides, sometimes require division on account of their permanent contraction, in consequence of rheumatism, or ankylosis of the knee. The operation is sufficiently simple, but requires some care to avoid

the nerves and vessels in the neighborhood of the affected structures. Forcible extension with the hand should be practised immediately after the section has been completed, and the subsequent treatment should be conducted by means of a hollow splint, composed of sheet-iron, worked by a screw, and applied to the posterior surface of the joint. The treatment must necessarily be tedious, demanding both patience and skill, but by proper perseverance a good cure may be effected. The best apparatus for keeping up the requisite extension is that sketched in fig. 638, and which may be readily procured of Mr. Gemrig, of this city.

#### HOUSEMAID'S KNEE.

An enlargement of the burse over the patella occasionally takes place, constituting an inconvenient and unsightly tumor, interfering with comfort and progression. It is most common in servant girls and persons who habitually exert much pressure upon this part, and is popularly known as the housemaid's knee. The immediate cause of the affection is inflammation, usually chronic, but now and then acute. The swelling is soft and fluctuating, semi-globular in shape, and unaccompanied by discoloration of the skin and enlargement of the subcutaneous veins. Some degree of soreness is usually present, but seldom any decided pain. The appearances of the parts are well shown in fig. 639, from a clinical case.

Fig. 639.



The *treatment* of this disease consists in evacuating the contents of the sac, and injecting it immediately after with a small quantity of equal parts of tincture of iodine and alcohol, the fluid being well pushed about, and permitted to remain until it is productive of some pain. Or, instead of this, a small seton may be inserted. The after-treatment consists of perfect repose of the parts and the ordinary antiphlogistic measures.

#### AFFECTIONS OF THE HAM.

A large *bursa* sometimes forms in the popliteal region, in connection with one of the tendons of the hamstring muscles, giving rise to a swelling which eventually seriously impedes the movements of the knee-joint. The tumor is characterized by the tardiness of its progress, by a sense of fluctuation, or peculiar puffiness, by an absence of pain, and by a freedom from discoloration of the skin. If any doubt



exists as to its real nature, recourse is had to the exploring needle. The treatment is by seton or injection with iodine. No judicious surgeon exsects such a tumor. In several instances in which the operation was practised, violent erysipelas ensued, necessitating amputation of the thigh.

Solid *tumors* of various kinds, as the fibrous, fatty, and encephaloid, are liable to occur in the ham, but they do not exhibit any peculiarities requiring special notice. Their progress and consistence generally afford sufficient evidence of their true character.

*Abscess* of the ham is occasionally met with; generally as a result of injury, or as a consequence of an extension of disease from the knee. The matter is commonly very deep-seated, and, therefore, slow in reaching the surface; the symptoms, both local and general, are unusually severe, and the fluctuation, especially in the early stage of the affection, is always very indistinct. The limb soon becomes stiff, the swelling is extensive, and the existence of pus is eventually indicated by an oedematous and erysipelatous state of the skin. The absence of pulsation will usually distinguish it from popliteal aneurism. Still, the surgeon must be upon his guard, not neglecting, in case of doubt, the use of the exploring needle. The proper treatment is a free and early puncture.

#### BANDAGE FOR THE KNEE.

For retaining dressings on the knee, as in inflammation and wounds of the joint, an ordinary roller may be used; or, what is more neat and convenient, a piece of muslin, from eight to ten inches in width, and about a yard and a quarter in length, the extremities of which are

Fig. 640.



split to within a short distance of its centre. The centre is then applied to the patella, and the ends, crossed behind the ham, are tied, respectively, above and below the knee, as exhibited in fig. 640, copied from Druiitt.

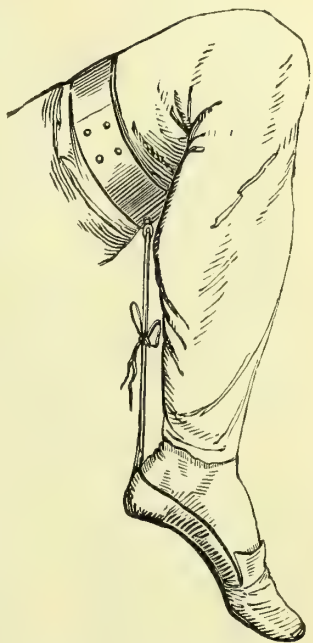
#### LACERATION OF THE TENDO-ACHILLIS.

This accident is always the result of the sudden and violent contraction of the gastrocnemial muscles, consequent upon inordinate exertion. It is most common in actors, beyond the middle age, and is probably generally connected with fatty degeneration of the substance of the tendon. The seat of rupture varies; but in most cases it is

rather low down towards the heel bone. The occurrence of the injury is commonly denoted by an audible snap, and by a sensation as if something had suddenly given way, the patient at the same time falling down, or finding it difficult to maintain himself on his limbs. The pain is very severe, and, on examining the parts, a distinct gap is discovered at the site of the laceration, similar to that which occurs in the operation for club-foot.

In the *treatment* of this accident, the indication is to maintain perfect apposition of the ends of the ruptured tendon until complete consolidation has been effected. Unless this be carefully met, a certain degree of lameness will almost be inevitable. The apparatus that is usually employed for this purpose is that devised by *Monro*, sketched in the adjoining cut (fig. 641). It consists, as will be perceived, of a slipper and a thigh-strap, connected by a cord, the object being thorough flexion of the limb, and consequent relaxation of the gastrocnemial muscles. Should the strap have a tendency to slip, it must be secured to the pelvis. The indication may also be fulfilled by applying a splint along the front of the leg and foot, as in fracture of the heel-bone, the leg having previously been bandaged from the knee downwards so as to control the action of the flexor muscles, and the limb being afterwards placed in an easy, relaxed position, over a large pillow. A cure usually follows in about five weeks, but the patient must be very careful for some time after, otherwise the connecting bond will either give way, or, at all events, become injuriously elongated.

Fig. 641.



Apparatus of Monro for maintaining flexion in ruptured tendo-Achillis.

## CORNES.

Corns consist in an indurated and hypertrophied condition of the cuticle, caused by inflammatory irritation of the superficial portion of the dermis, and a consequent effusion of lymph. They affect different parts of the toes and feet, and are generally produced by wearing tight shoes and boots, whereby these organs are habitually compressed and even forced out of their normal position. Corns are very variable in regard to their size, form, and consistence. They are usually distinguished into hard and soft.

*Hard* corns are dry, scaly, insensible callosities, occurring mostly on the dorsal surface of the toes, opposite the middle joints. All these structures are occasionally affected, but the great and little toes suffer

much more frequently than any of the rest. These bodies are met with also in the sole of the foot, in the hollow or arch, and on the under part of the heel. Occasionally a very hard corn is found under the nail of the big toe, or between the nail and the fleshy flap of the toe.

A hard corn, when fully developed, is lamellated, firmer at the centre than at the periphery, and furnished with a sort of nucleus, of a whitish, horny appearance, not unlike the eye of a fowl. A small, but distinct burse, containing a minute quantity of serous fluid, and sometimes a drop of blood, is almost always interposed between it and the dermis. The hard corn frequently consists of three or four layers; it is commonly of a circular shape, is either fixed or movable, and varies in size from the head of a pin to that of a dime. In many cases it has a sort of radiated root.

The hard corn, from a continuance of the pressure by which it is produced, becomes gradually a source of pain and tenderness, which are much increased by exercise, and are often accompanied by heat and swelling of the whole foot. In time the burse under the horny cuticle inflames, and pours out an unusual quantity of fluid, which distends the sac, and thus greatly aggravates the suffering. When matter forms the pain becomes excruciating, the slightest touch is intolerable, and the patient is unable to use the limb. In such cases the lymphatic vessels are sometimes inflamed as high up as the groin.

*Soft* corns are always situated between the toes, usually opposite a joint or at their angle of union, and derive their characteristic feature from being in a constant state of moisture, from the perspiration which collects between these parts; they are usually superficial, and are produced by wearing very narrow soled-shoes, by which the toes are habitually squeezed together, bent at their articulations, or forced over or under each other. For this reason ladies are more subject to this variety of corn than men or the poorer classes of females. The soft corn is of a circular or oval figure, of a whitish, yellowish, or grayish color, with a radiated or horny-looking nucleus, and seldom larger than a split-pea or half a dime. Occasionally it is broad, oblong, flat, and of a dark color, from the presence of extravasated blood. In some instances, especially in old people and in cases of long standing, the corn is very hard at the centre, has a small synovial burse, and consists of several distinct layers. From being constantly compressed, it is very painful, and remarkably prone to inflammation, suppuration, and even ulceration.

The *treatment* of corns consists in scraping away the thickened cuticle, and lightly touching them with nitrate of silver, or tincture of iodine, which may be repeated occasionally until the cure is completed. This may be greatly expedited by washing the feet night and morning with cold water and soap, and afterwards rubbing them well with a soft, dry towel. The shoe, which should have a low, broad heel, should be accurately adapted to the shape of the limb, and all undue pressure carefully avoided, even from the seam of the stocking. When the toes are much deformed, or incurvated, they are to be kept apart by pledgets of lint, a piece of soft sponge, or adhesive plasters passed from one to the other. When this cannot be done from their fixed



position, amputation may become necessary. In some instances it is useful to make the patient wear a stocking constructed on the principle of a glove, each of these organs having a separate stall. A shoe or boot made of buckskin or cloth, sometimes affords great relief.

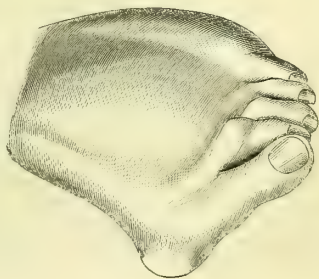
When the corns are very tender they should be frequently scraped with a blunt knife, and kept constantly covered with a piece of soap plaster, or a bit of linen spread with simple cerate, to prevent them from becoming hard and dry. In some instances the pressure may be warded off by letting the corn project through a hole in the plaster, which ought then to be very thick, or consist of several layers. When the corn is seated in the sole of the foot, and this treatment is employed, it must be first covered with a piece of adhesive plaster, otherwise the weight of the body will cause the flesh to bulge into the opening, and thus produce severe pain in walking. Occasionally it is necessary to cut a hole in the boot or shoe, or to wear a felt sole with a hole in it, to protect the corn from pressure and friction. All these means, however, are merely palliative, and, when they fail, nothing short of complete eradication will answer. The operation, which is seldom painful, is performed with a small narrow-pointed scalpel and pair of forceps, care being taken not to injure the sensitive skin beneath, and to soften the corn by previous immersion in warm water. When an abscess forms, it should be opened as speedily as possible, after which the offending part may be removed, or this may be postponed to another day. Sometimes the matter escapes by ulceration, leaving a fistulous sore with thick, irregular edges, and constantly bathed with a thin, ichorous fluid. In such a case nitrate of silver constitutes the best remedy.

When corns are inflamed they cannot be treated with too much care, since, when neglected, they may give rise to serious mischief. The foot should be kept perfectly at rest, and it may even be necessary to resort to leeches and medicated fomentations. The knife should be used most cautiously. Several instances have fallen under my observation where, under such circumstances, the cutting of a corn was followed by violent erysipelas and mortification.

## BUNIONS.

A bunion is a corn on a large scale, caused in a similar manner, having a similar structure, and requiring a similar treatment. It consists in a thickening and induration of the common integument over the first metatarso-phalangeal joint, accompanied by a malposition of the great toe, which is usually forced inwards, either against, over, or under the adjoining one, thus occasioning a sharp, angular projection on the outside of the articulation. These appearances are well shown in the adjoining drawing (fig. 642) from a female patient. The whole difficulty is originally dependent upon the wearing of a short,

Fig. 642.



narrow-soled, high-heeled boot, by which the whole weight of the body is thrown upon the anterior part of the foot in progression. A similar tumor sometimes forms over the first joint of the little toe. Hereditary malformation, preternatural laxity of the ligaments, and a gouty or rheumatic state of the system, may be mentioned as so many predisposing causes of the complaint.

The cuticle, when the disease is somewhat advanced, is thick, scaly, or lamellated, hard, brawny, and at times studded with superficial corns; the subjacent burse, which is often of large size, contains a considerable quantity of synovia; and the corresponding joint of the toe is always chronically inflamed and hypertrophied, if not partially ankylosed. Exercise is painful, and never fails to aggravate the disorder, not unfrequently occasioning erysipelas of the foot, and abscess in the sac of the bunion.

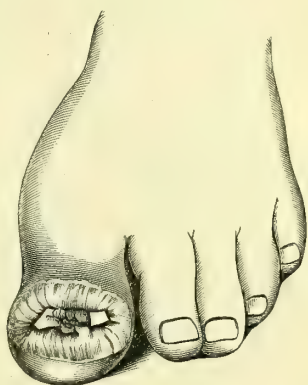
The *treatment* of this complaint is palliative and radical. The first thing to be done is to procure a proper shoe, in order to diffuse the pressure over the foot, instead of concentrating it upon the toes. Pain, tenderness, and inflammation are best relieved by rest and elevation, aided by leeching, blistering, and cold water, medicated with laudanum and acetate of lead. If matter form, an early and free incision is made down to the bones. A radical cure may be effected by excision of the sac, but, unless the part and system have been well prepared, the operation may prove dangerous from its liability to be followed by erysipelas. A much safer plan is to divide the sac subcutaneously with a delicate tenotome, cutting it up into numerous fragments, and then pencilling the surface of the swelling several times a day with tincture of iodine. I have practised this procedure in numerous cases with highly gratifying results. Amputation through the metatarsal bone may become necessary when the parts are hopelessly crippled, and the seat of constant suffering.

#### ONYXITIS.

Onyxitis usually begins in a small circumscribed swelling of the ungual matrix, attended with more or less pain and discoloration of the skin. A narrow ulcer or cleft soon appears at the root of the nail, and gives vent to a thin, ichorous fluid. The sore gradually extends, until it finally involves the whole of the ungual matrix, or even the entire nail. The surface has a foul, dirty aspect; the margin is thin and sharp; the discharge irritating and offensive. The skin around the ulcer is indurated, tender, and livid; the nail is yellowish, brownish, or black, dry, and disfigured; and the affected member, often twice or thrice the normal size, has a peculiar bulbous appearance. In some instances the nail becomes loose, and ultimately drops off. The pain is generally slight, but occasionally it is so excessive as to deprive the patient of appetite and sleep for days and nights together. The disease is slow in its progress, and may continue for many months before it is arrested. Although not strictly of a malignant nature, its tendency is to destroy the affected nail, and to produce serious changes in the surrounding structures.

Onyxitis is most frequently met with in the great toe, thumb, and index-finger. It occurs chiefly in scrofulous, ill-fed subjects, before the age of twelve or fifteen. External injury, as a bruise or puncture, may produce the disease, but in most instances it arises without any known cause. The general health often suffers in this complaint, and the secretions are almost always considerably disordered. The annexed drawing (fig. 643), from a clinical case, conveys an excellent idea of this affection as it occurs in the great toe.

Fig. 643.



The *treatment* of onyxitis is sufficiently simple. After the bowels have been cleared out, and the secretions re-established, the system should be brought under the influence of mercury, carried to the extent of slight ptyalism. The best preparations are calomel and blue pill, the latter of which is usually preferable, because it is more mild and gradual in its operation. It may be administered two or three times a day, in the proportion of from three to five grains at a dose, with a small quantity of opium to prevent griping and purging. As soon as the gums become tender, the medicine must either be entirely withheld, or used at longer intervals, and in smaller quantity. The effects of the mercury, however, should be steadily maintained for several successive weeks, otherwise the disease will be sure to re-appear, or to resume its original character. The local treatment should be of the mildest description. The sore should be washed several times a day with tepid water and soap, and its surface should be kept constantly covered with scraped lint, wet with a weak solution of chlorinate of soda, creasote, nitric acid, or the compound tincture of myrrh and aloes. In several instances I have derived great advantage from the use of lime-water, containing two grains of bichloride of mercury and the same quantity of opium to the ounce. When there is much inflammation in the parts around the sore, the warm water-dressing, or an emollient poultice, will afford great relief. As soon as the ulcer assumes a healthy aspect, the best application is the opium cerate. Evulsion of the nail can answer no useful purpose, nor is it proper to amputate the affected part, unless, after the cure is effected, it is found, by its bulk or unseemliness, to interfere with the convenience and comfort of the patient.

#### INVERSION OF THE NAIL OF THE BIG TOE.

The big toe is subject to the inversion of its nail, consisting, as the name implies, in an ingrowing of its edges into the common integuments. The affection is productive of severe suffering, and is, therefore, as well as on account of the frequency of its occurrence, deserving of particular attention. It is not peculiar to the big toe nail, although



it is most common here, and it is here also that it has been best studied. It is most frequent in young adults, and occasionally exists in several members of the same family. Several cases have come under my observation where it began very early in life, and under circumstances which induced me to believe that it might have been hereditary. Thus, I know two instances where a mother and two of her children are all afflicted with the disease.

The affection consists essentially in a vicious formation of the nail, in consequence of which its edges become incurvated, and pushed down into the skin at the margin of the toe, which thus overlaps them. This often happens with the hardest as well as with the softest nail. The incurvation generally exists on both sides, though rarely in an equal degree, and we sometimes meet with cases where both the big toes are involved. When the affection is fully developed, the edge of the nail dips into the flesh almost vertically, leaving a well-marked gutter upon the removal of the offending part. Long, however, before it has attained this height, it becomes a source of severe suffering, on account of the pressure which it exerts upon the soft parts at the side of the toe, which are rendered, at first, inflamed and tumid, and afterwards ulcerated, the sore discharging a foul, unhealthy matter, and being usually covered with tender, fungous granulations. In some cases the inflammation is spread nearly over the whole toe, which is then proportionably painful, and thus greatly augments the distress; so that, at length, the patient is in constant misery, and hardly able to wear a shoe, or take any exercise. The habitual use of a light, narrow shoe, causing severe lateral pressure, no doubt often contributes to the production of this affection, but in many cases it takes place without any obvious cause. Once formed, it is extremely difficult to get rid of it. Great convexity of the nail no doubt acts as a powerful predisponent.

Various *remedies* have been suggested for the cure of this affection, most of which can hardly be regarded even as palliatives. Paring the inverted portion of the nail occasionally with a sharp knife, and removing the callous skin by its side, will always afford marked relief, and will, if steadily persisted in, sometimes eradicate the evil, but, in general, it will soon return, and ultimately call for a more decisive procedure. Scraping the back of the nail, so much lauded by certain surgeons, is commonly useless, as it hardly yields even transient comfort. Dr. Robert Campbell, of Georgia, has recently recommended systematic compression with a small compress and roller, but the operation, without being by any means free from pain, is troublesome and tedious, from six to eight weeks being required to effect a cure. When the affection is fully formed, and the patient's time is valuable, the best plan is at once to excise the offending portion of the nail, chloroform being given to prevent suffering, which will otherwise be excessive. With a stout, narrow, and very sharp scalpel, the nail is divided through its whole length, down almost to the bone, on a line with the incurvated edge, which is then rapidly detached, root and all being embraced in the dissection. Very little bleeding attends the operation, which is over in a few seconds. Warm water-dressing is applied, and

the foot is kept at rest until the wound is measurably healed. I generally excise both margins at the same time. By this procedure a large portion of the nail is left for the protection of the toe, and a radical cure secured. Everything else is, I am sure, merely palliative, the patient being at last obliged, perhaps after long suffering, to submit to the knife.

## EXOSTOSIS OF THE GREAT TOE.

The last phalanx of the great toe is sometimes the seat of an exostosis (fig. 644), so large as to cause serious inconvenience and pain in walking. It may appear at various points of the bone, but generally it is seated on its upper surface, partly under the nail, which, in time, it lifts up and partially destroys by ulceration. Its form is spherical or pyramidal, and in size it varies from that of a millet seed to that of a hazelnut, its structure and consistence resembling those of the natural osseous tissue. Arising generally without any assignable cause, its origin is usually ascribed to a blow, or to the pressure of a tight shoe; it is most common in young adults, is slow in its progress, and is amenable to excision with a stout knife, aided, if necessary, by the saw. Amputation of the phalanx is not to be thought of, unless the whole bone, nail, and soft parts are involved in destructive ulceration.

Fig. 644.



Exostosis of distal phalanx of great toe.





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THE END.









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